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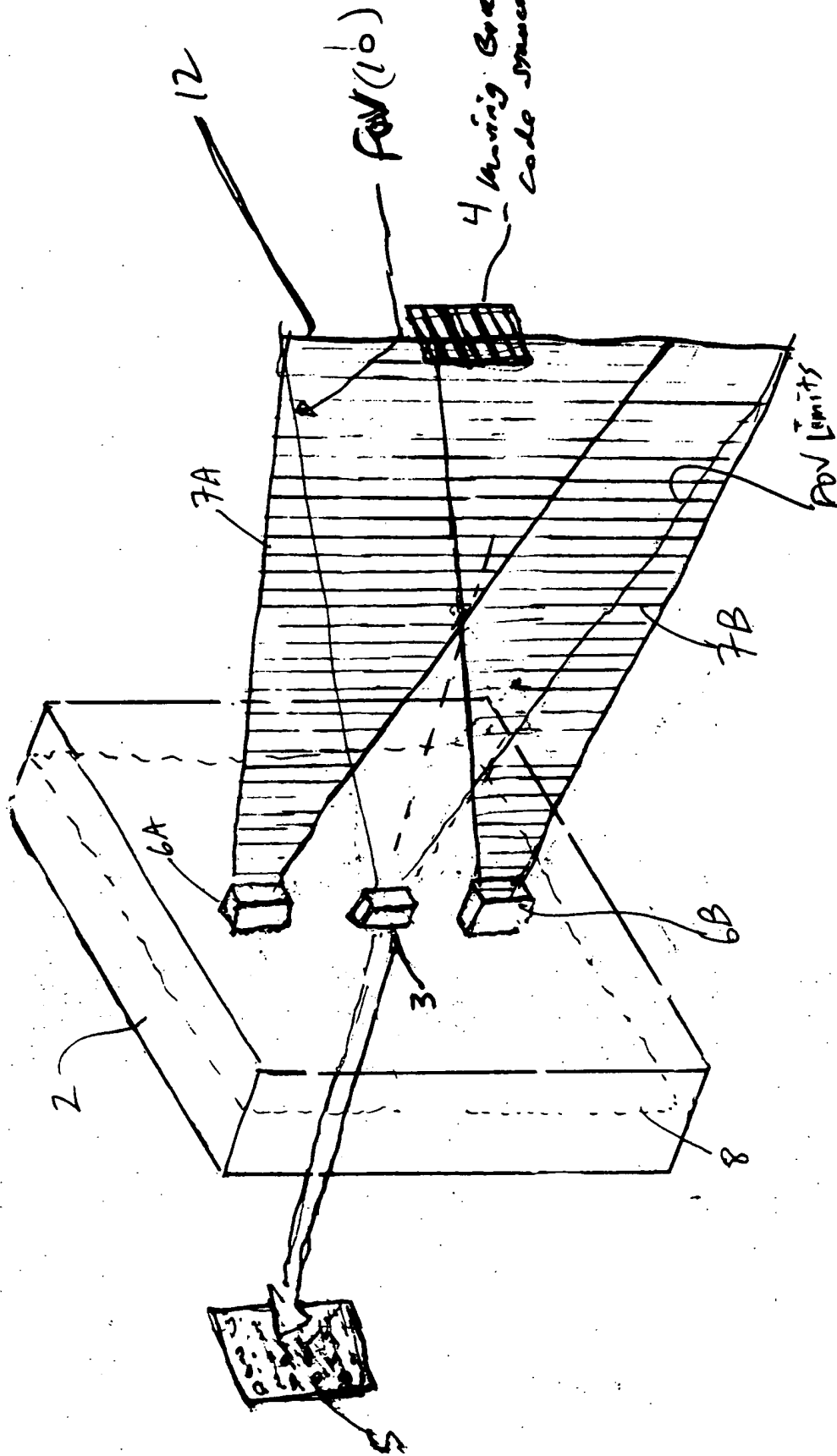
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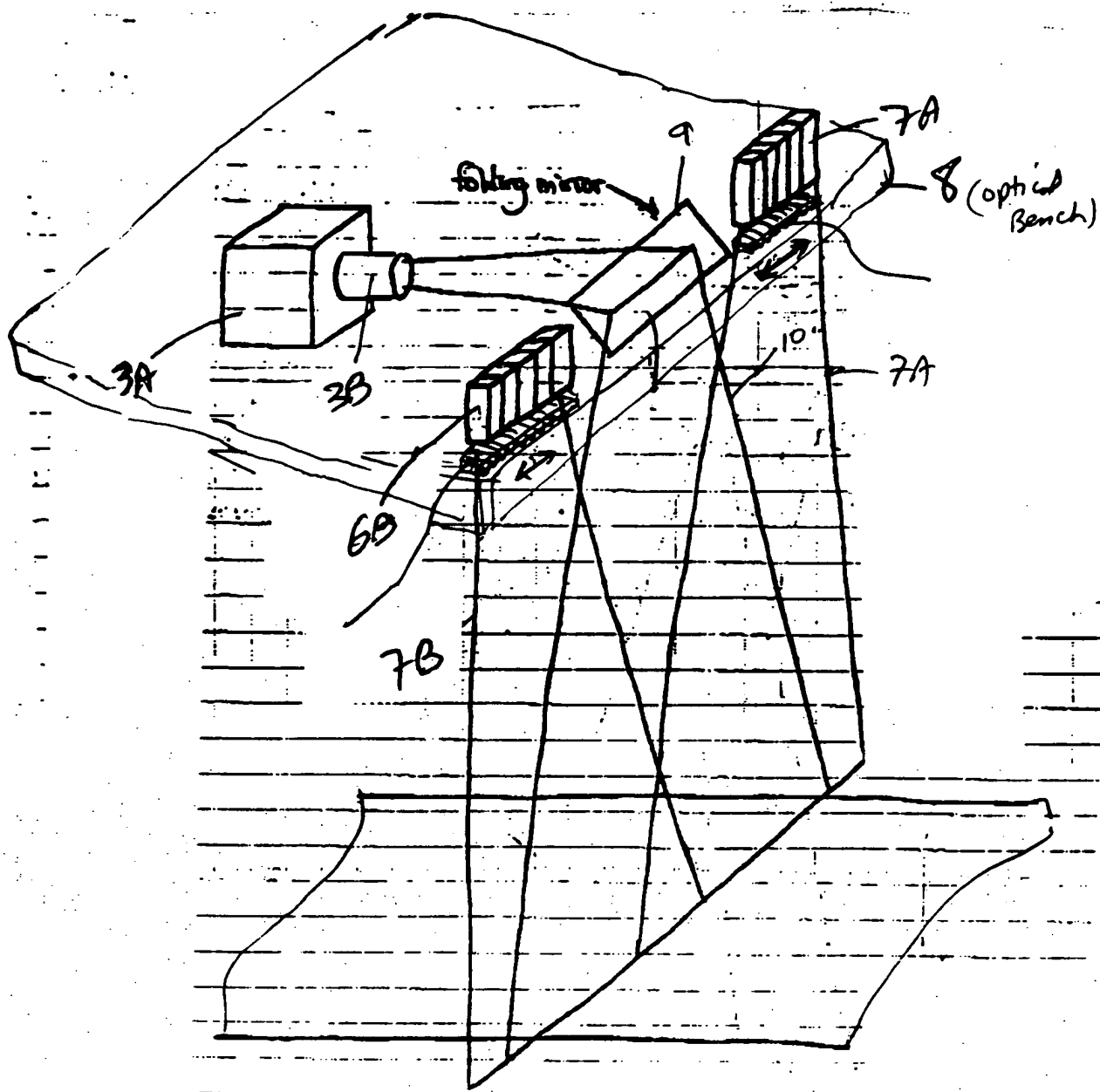


FIG 1B1

1A

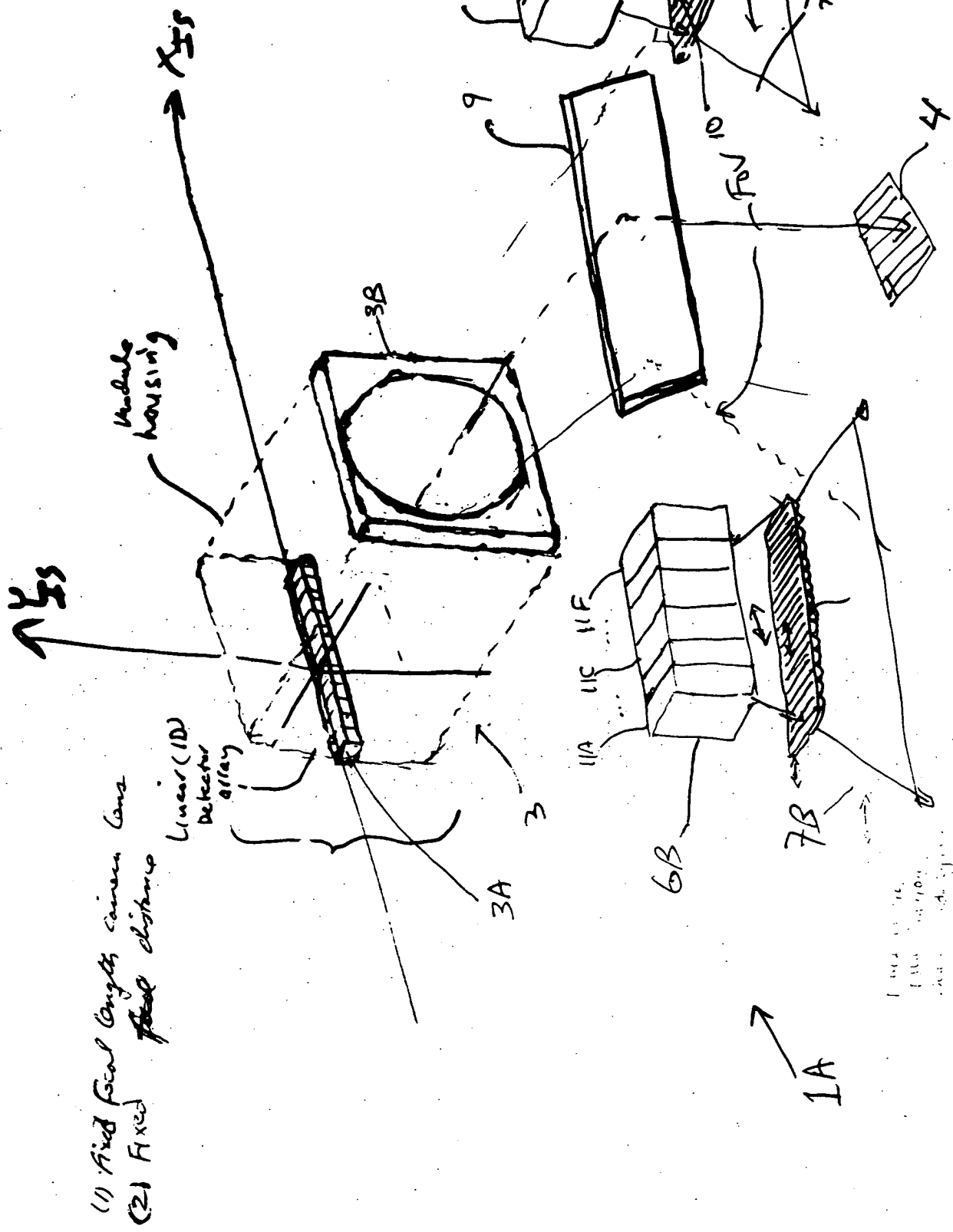


FIG. 1B2

1

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$$I(y_c) = \text{gaussian}$$

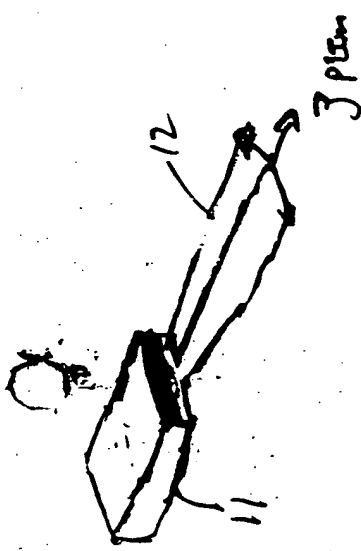


FIG. 1C

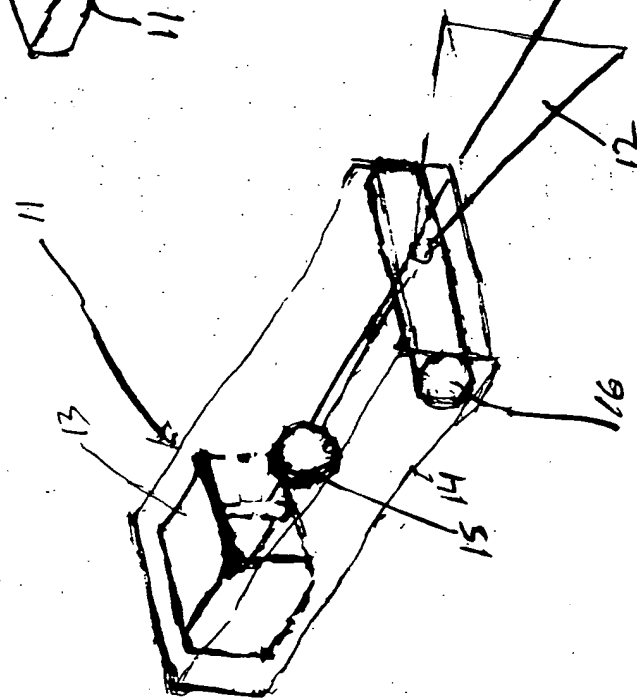


FIG. 1D

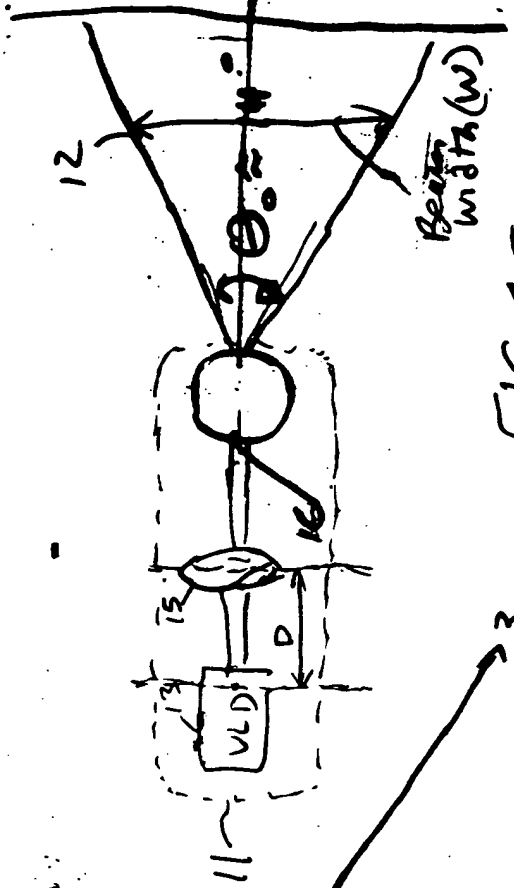


FIG. 1E

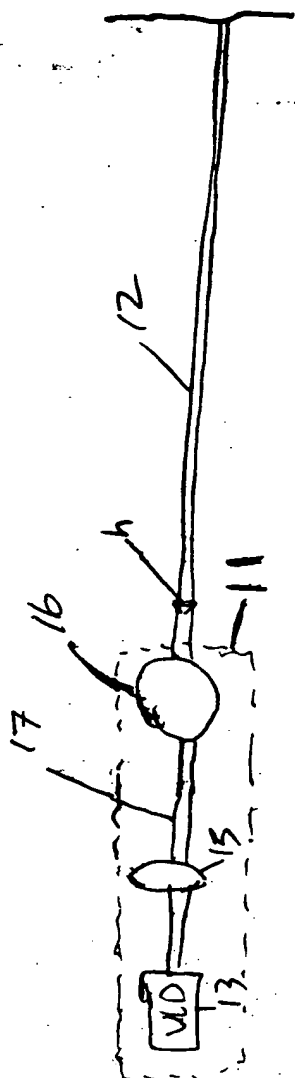


FIG. 1F

Minimum
object
Range

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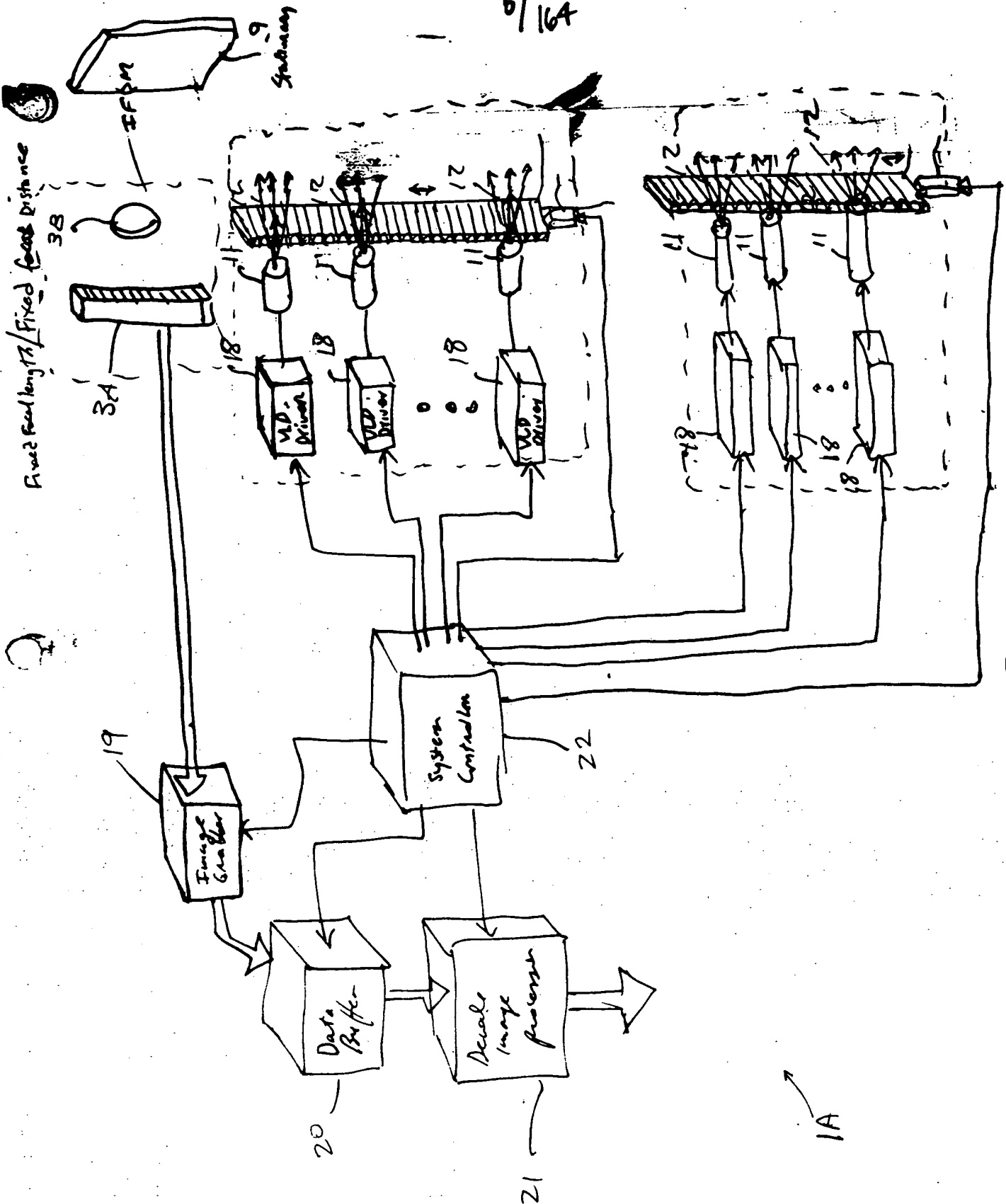


FIG. 1F

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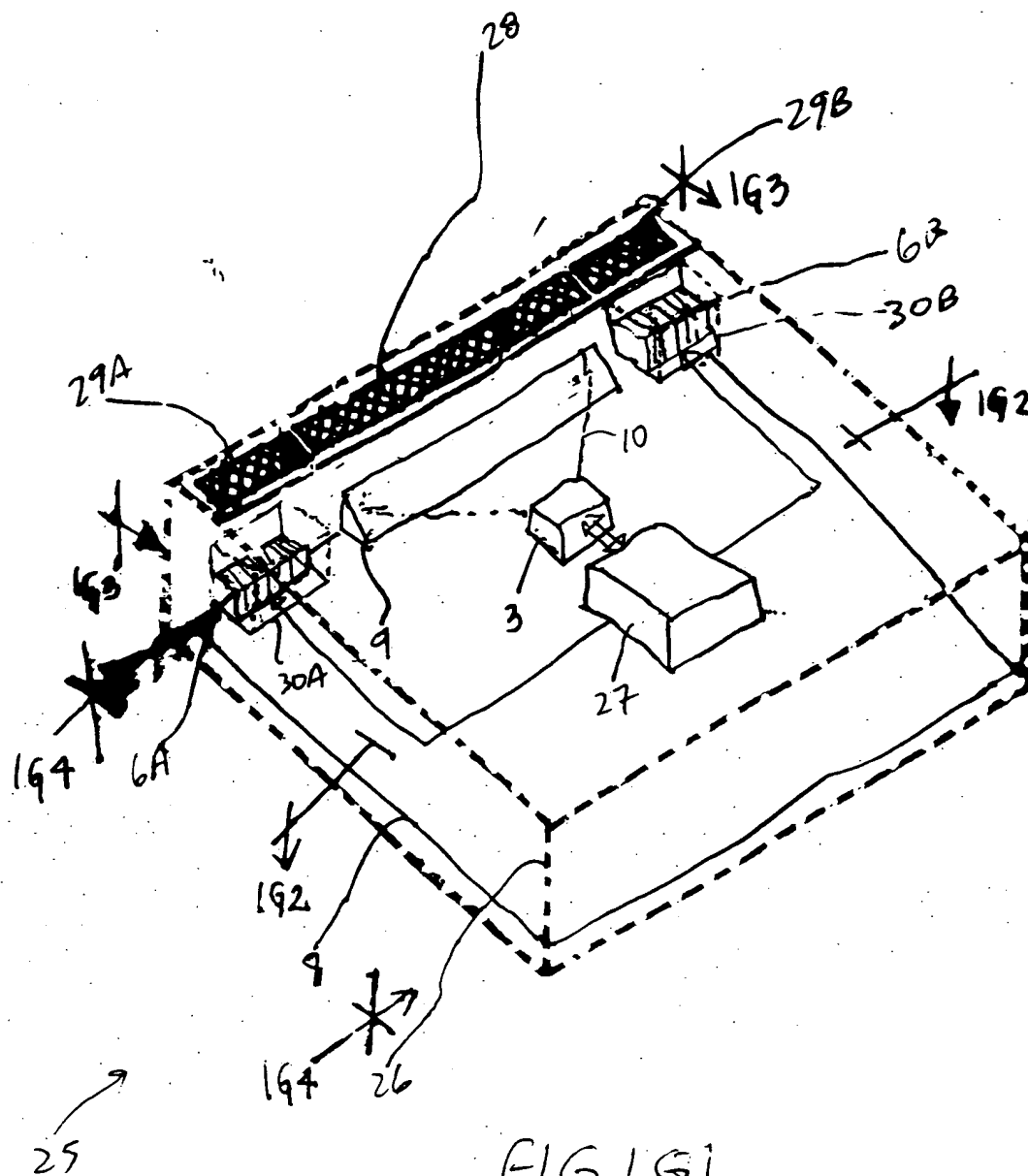


FIG 1G1

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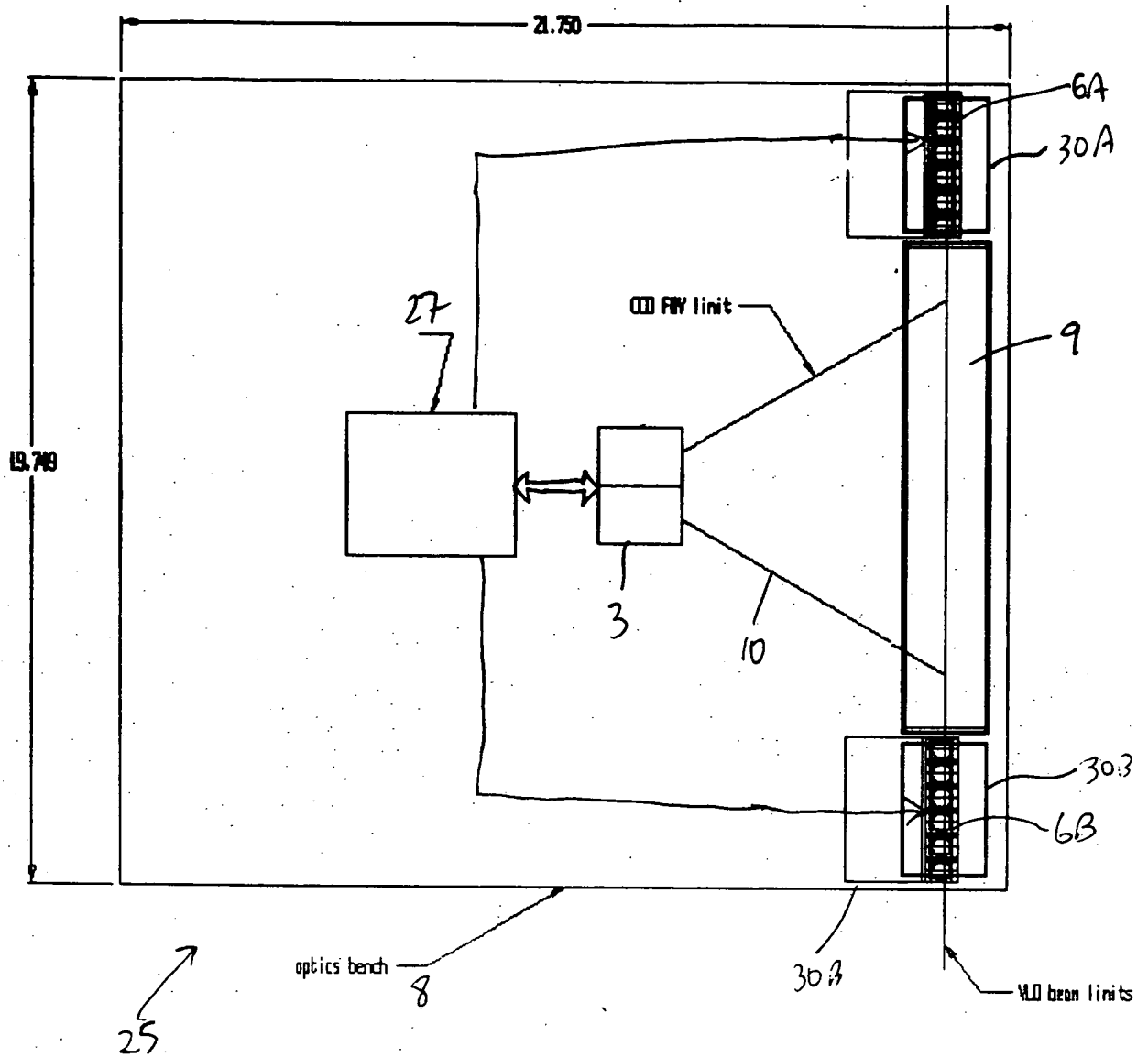
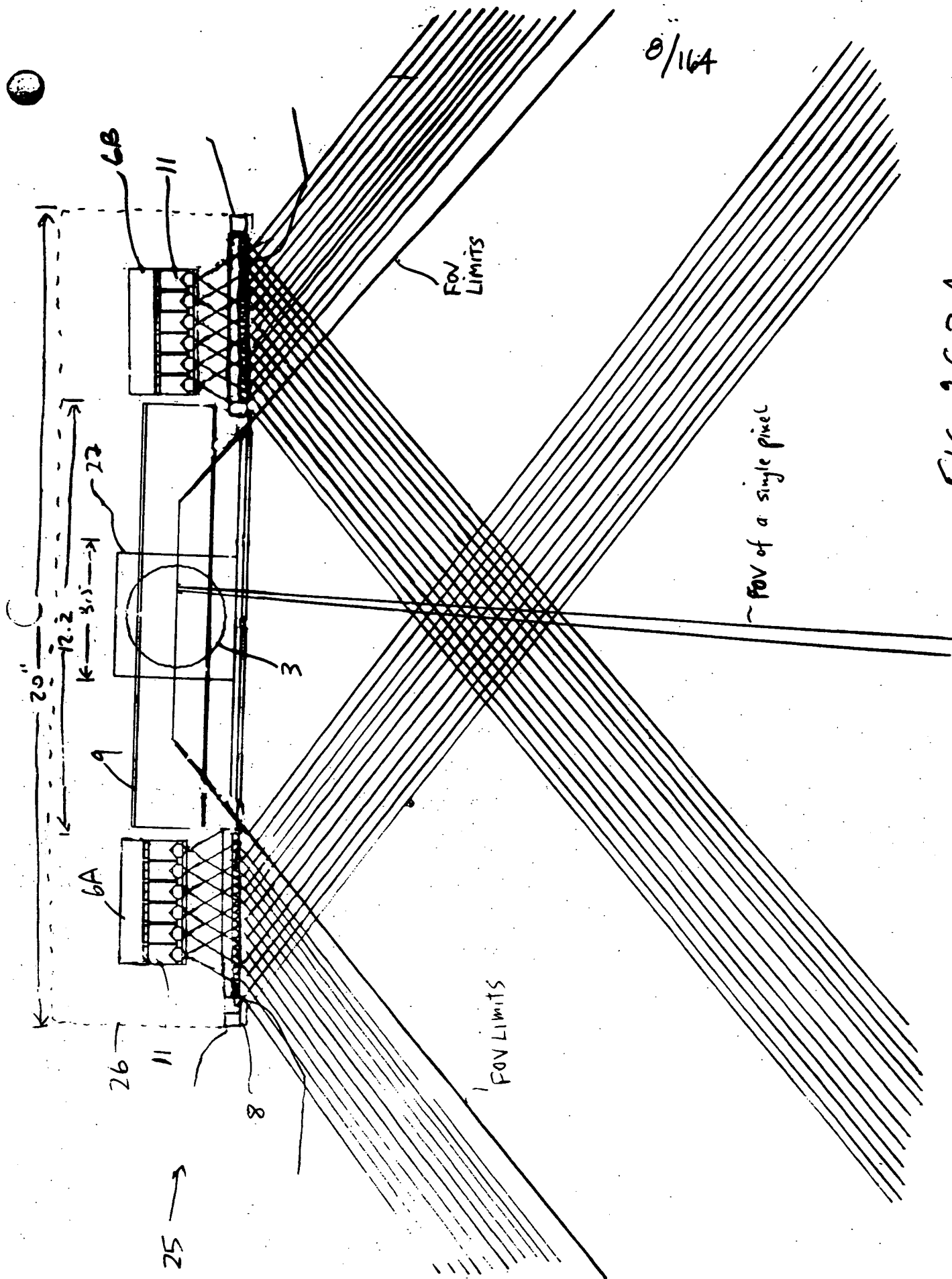


FIG. 162



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FIG 1G3A

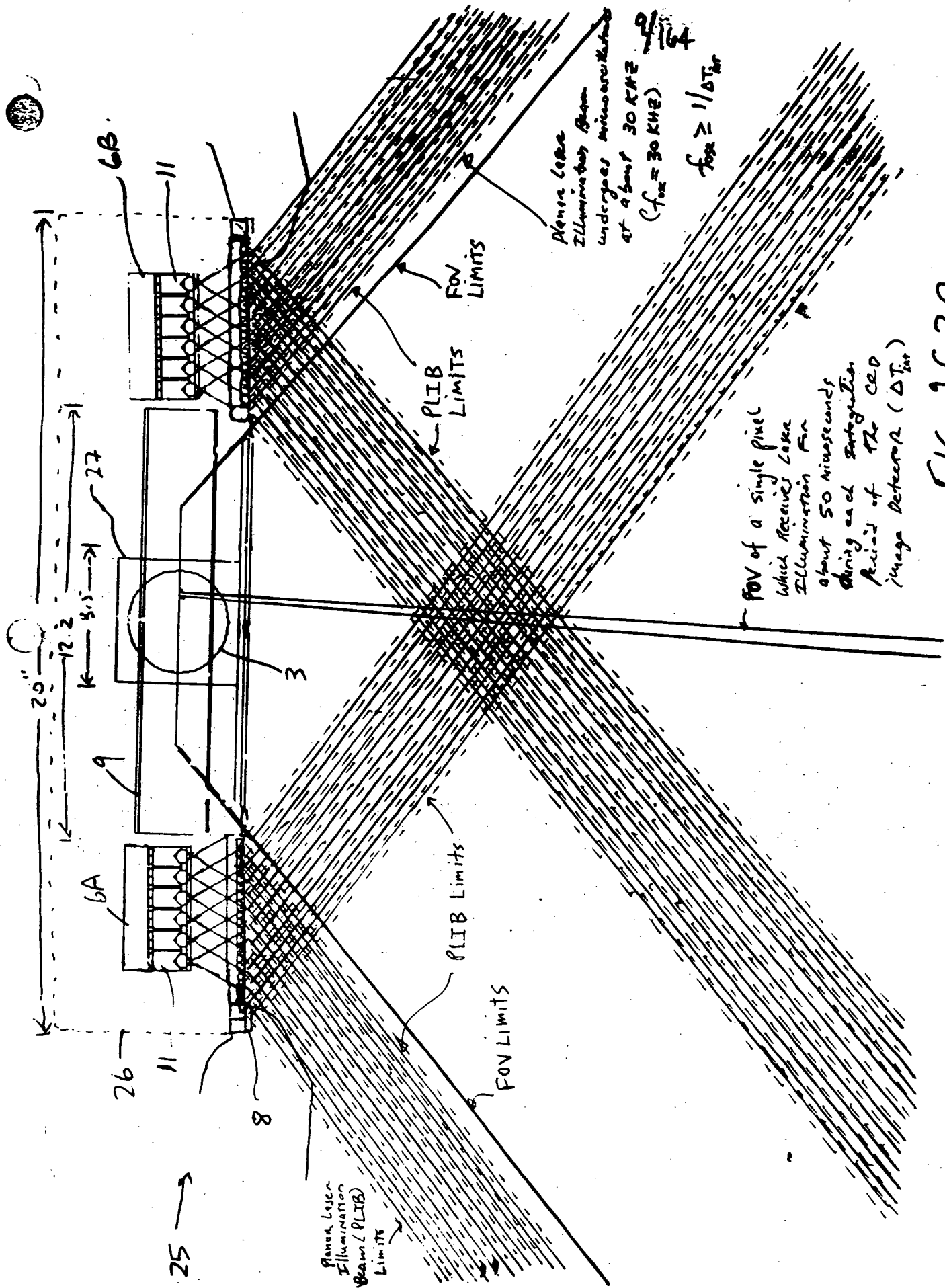


FIG 193B

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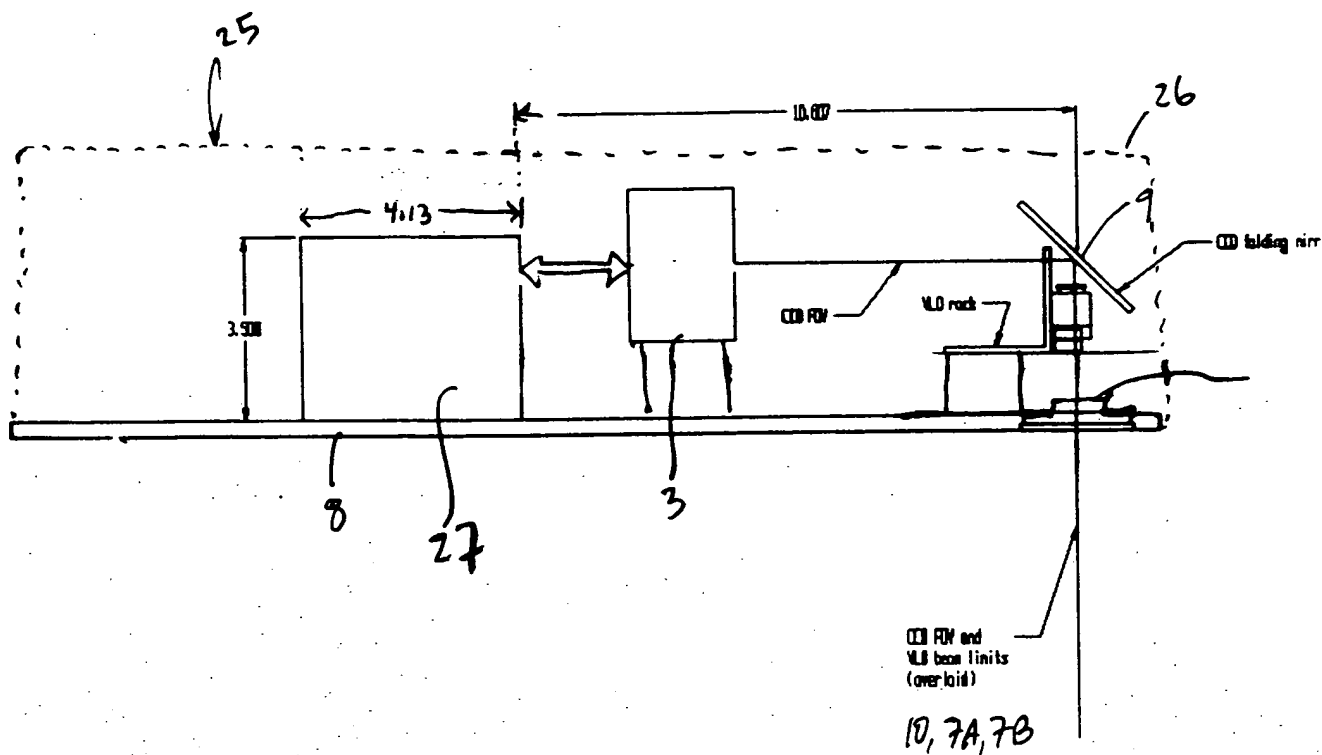
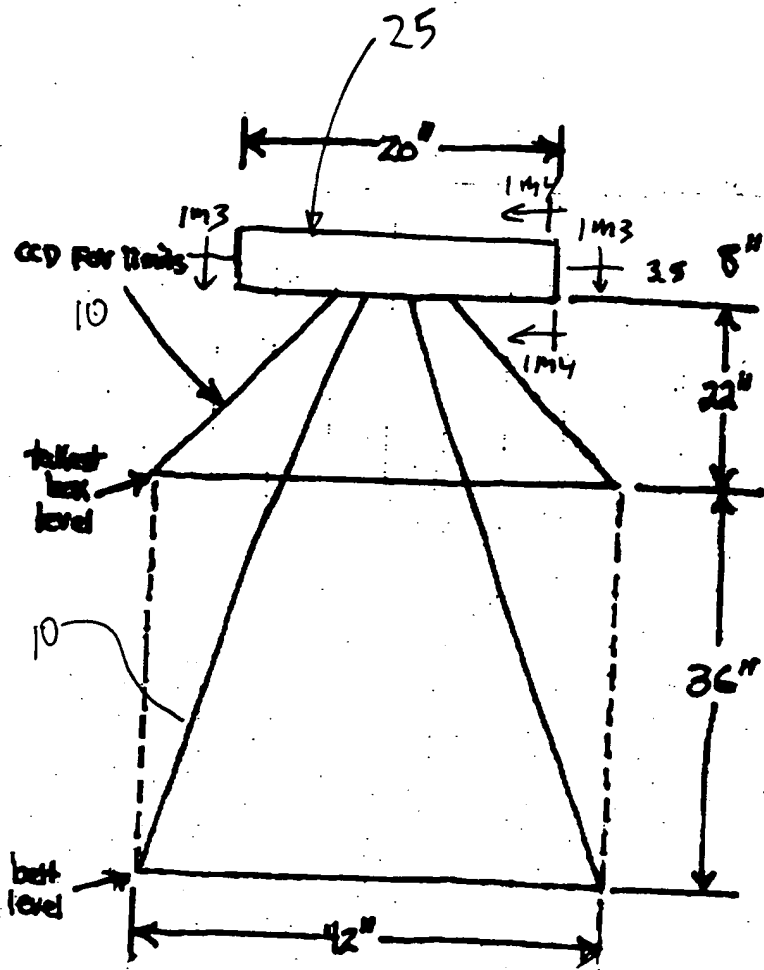


FIG. 164.

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* Fixed Field of Field

FIG. 165

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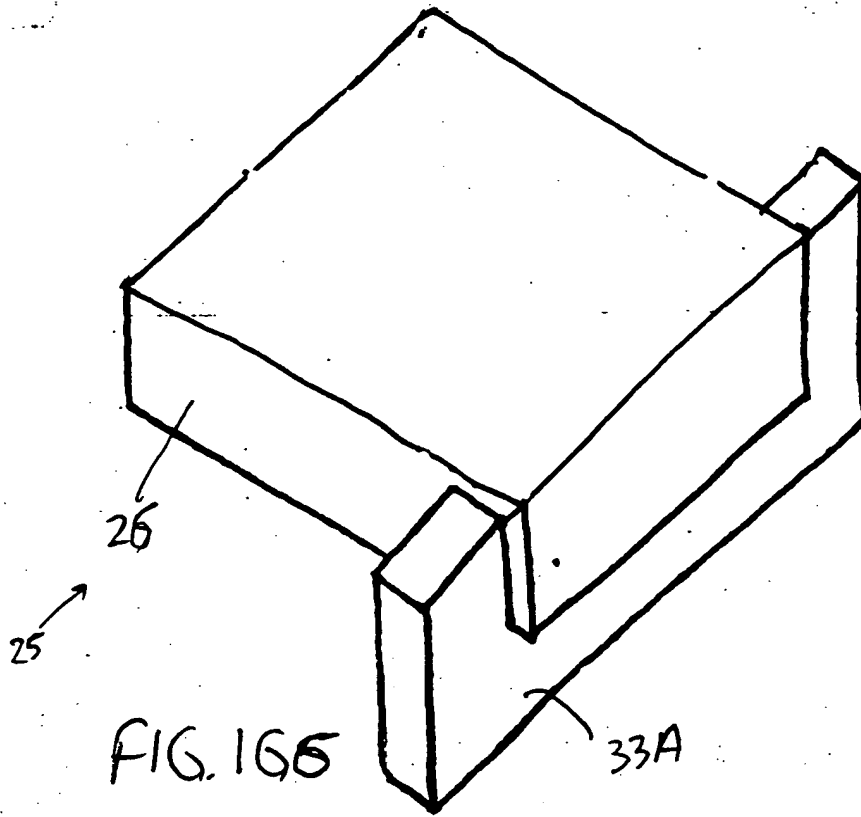


FIG. 165

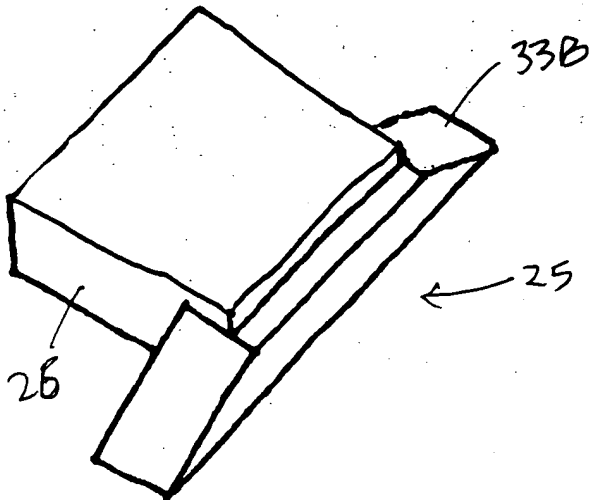
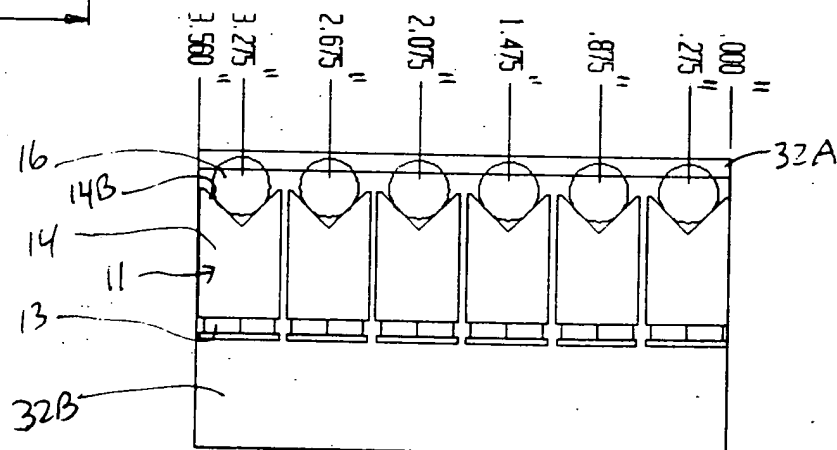
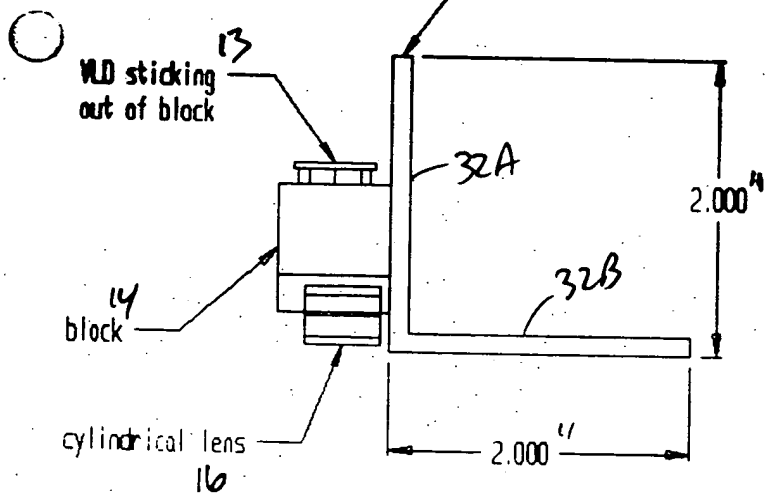
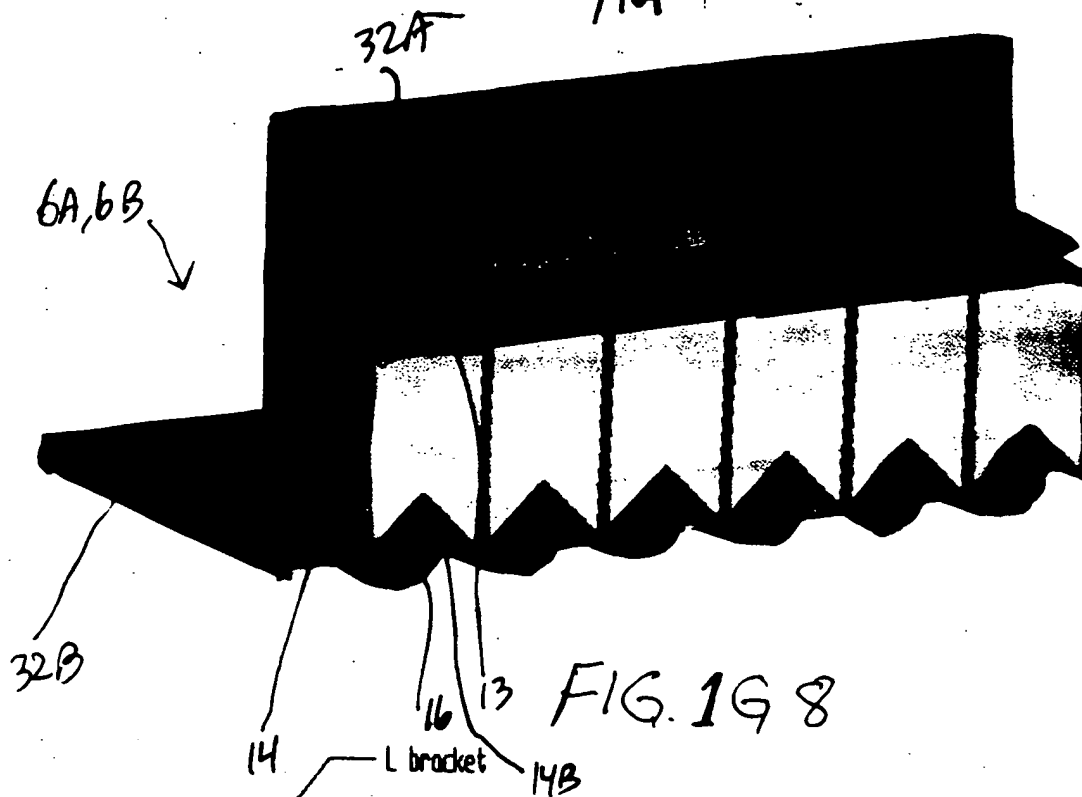


FIG. 167

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12
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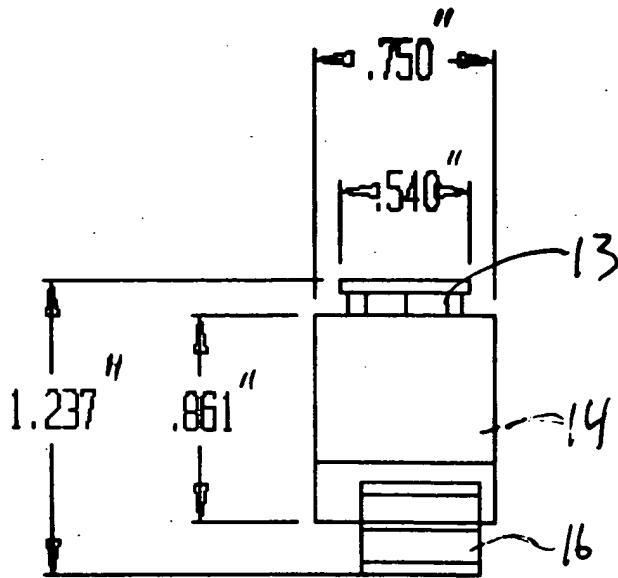


FIG. 1611

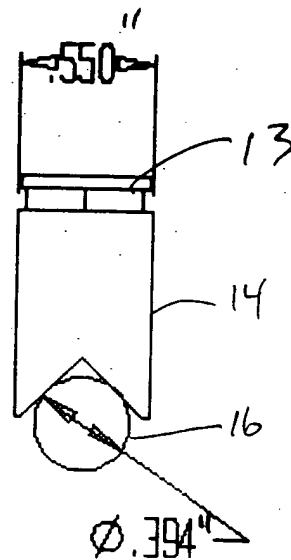
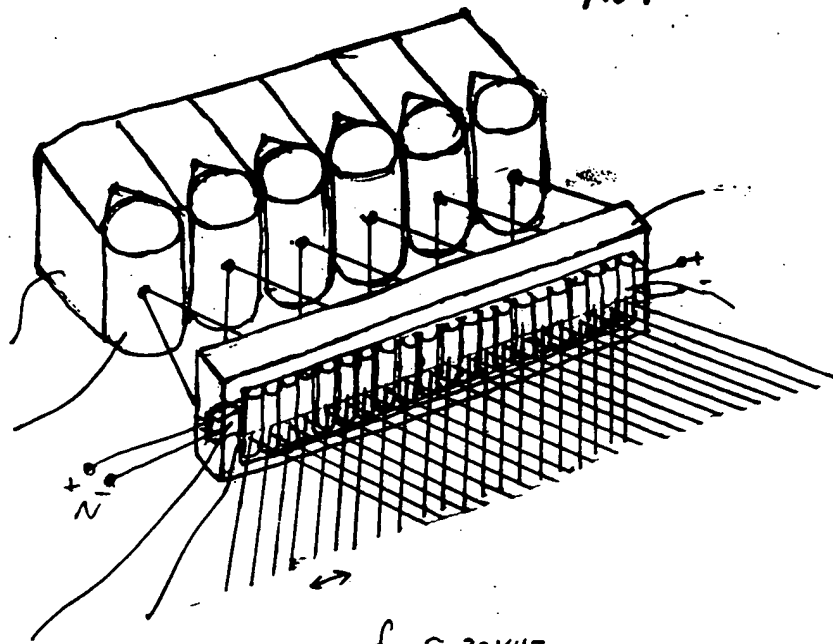


FIG. 1612

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$f_{osc} \approx 20 \text{ KHZ}$

FIG. 1G13

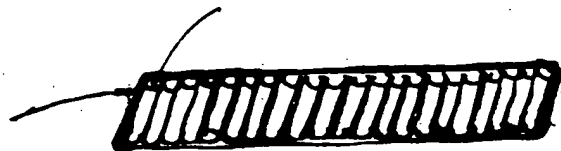


FIG. 1G14

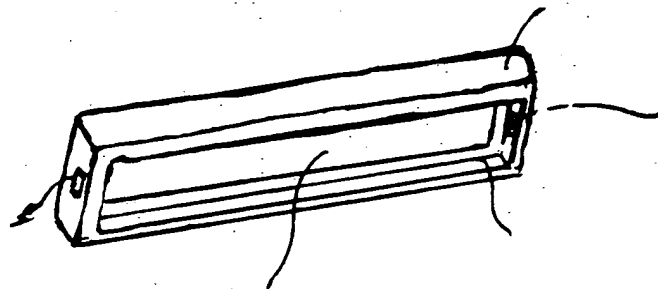


FIG. 1G15

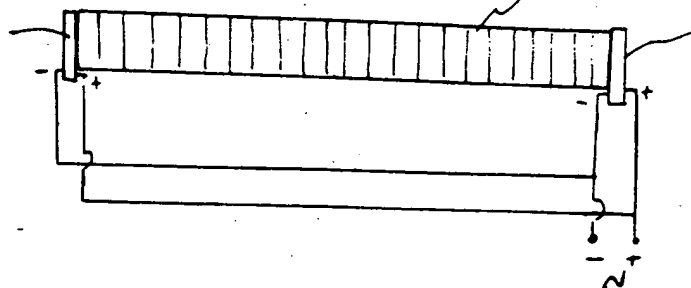


FIG. 1G16

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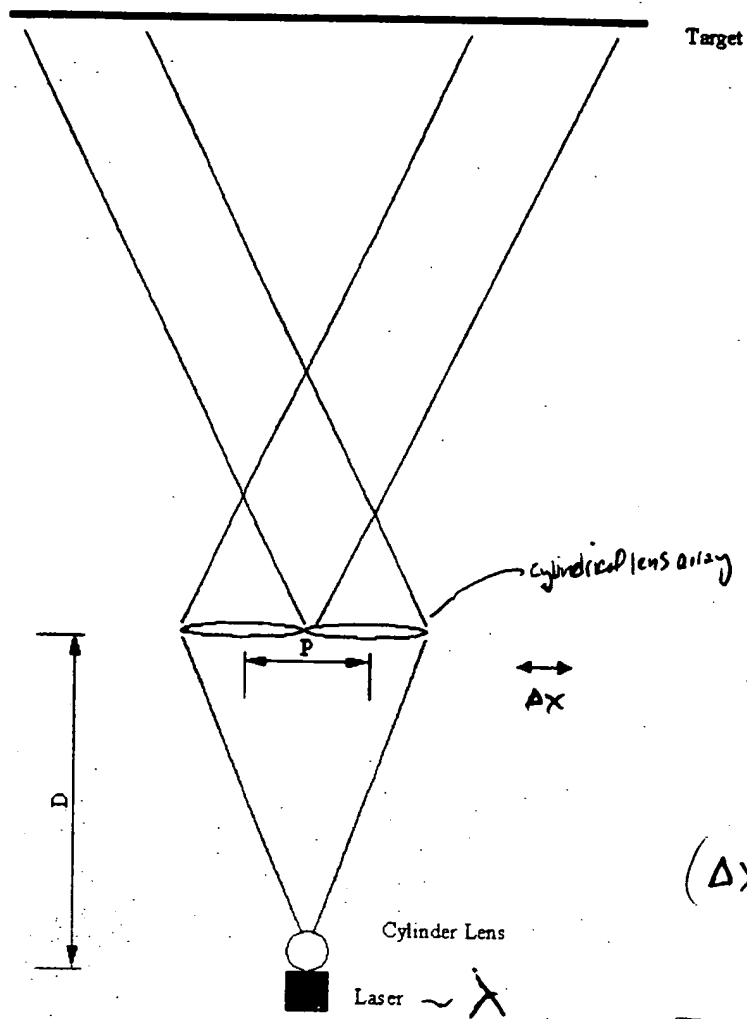


Figure 1

$$(\Delta x / D) P = \lambda$$

$$\Delta x \geq \frac{\lambda}{P} \cdot D$$

FIG. 1G13A

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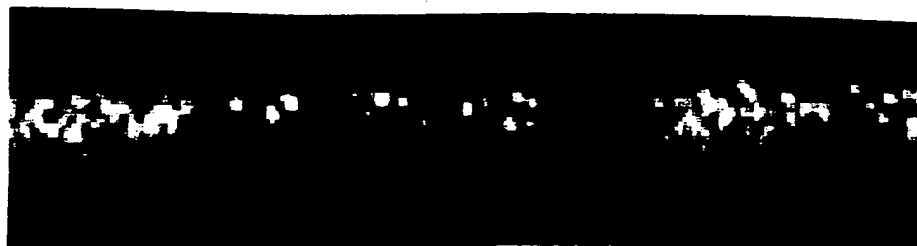
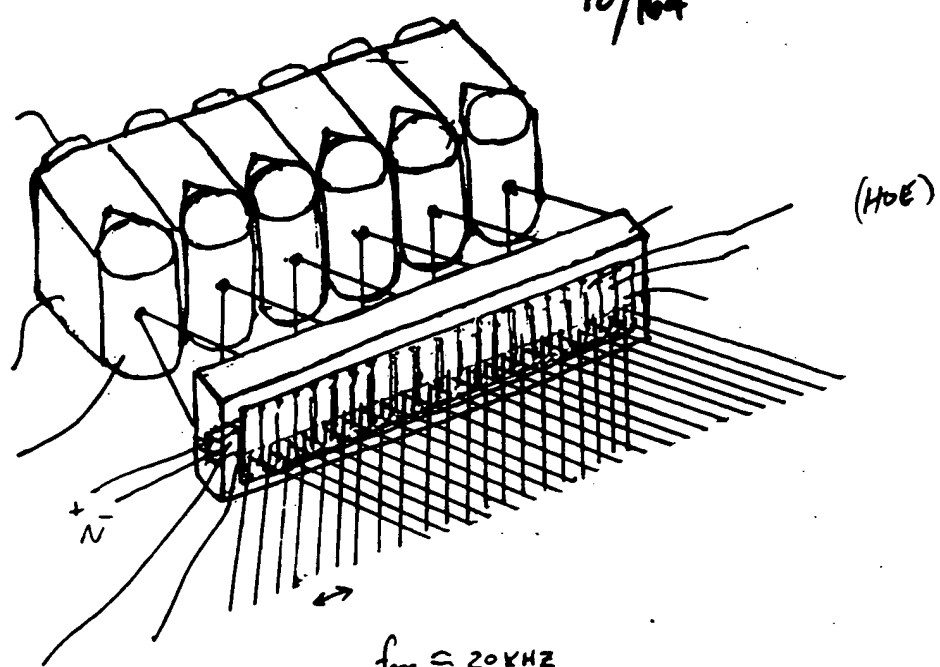


FIG. 1G13B1



FIG. 1G13B2

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$f_{\text{osc}} \approx 20 \text{ KHZ}$

FIG 1G17



holographically-fabricated
cylindrical lens array

FIG. 1G18

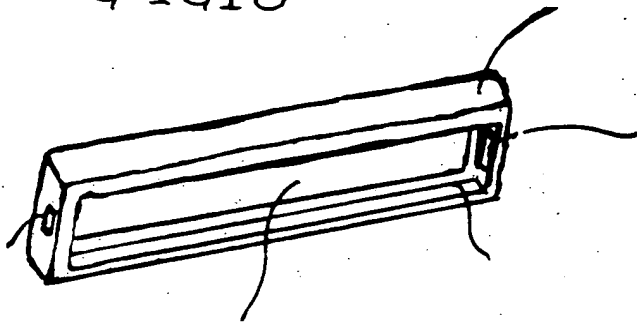


FIG 1G19

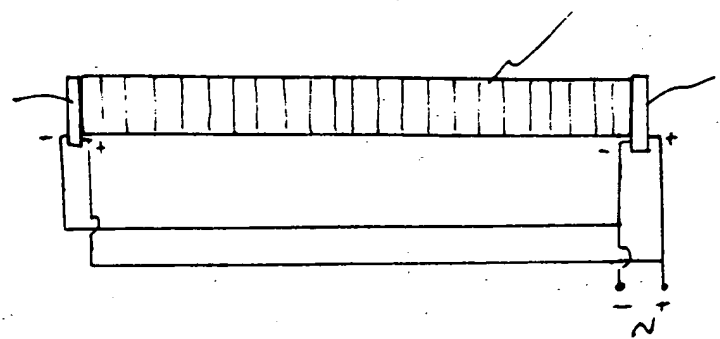


FIG. 1G20

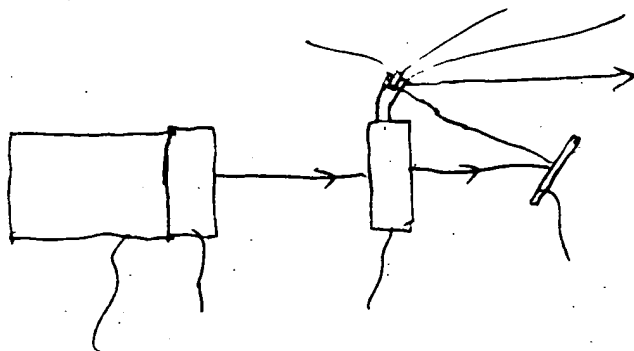
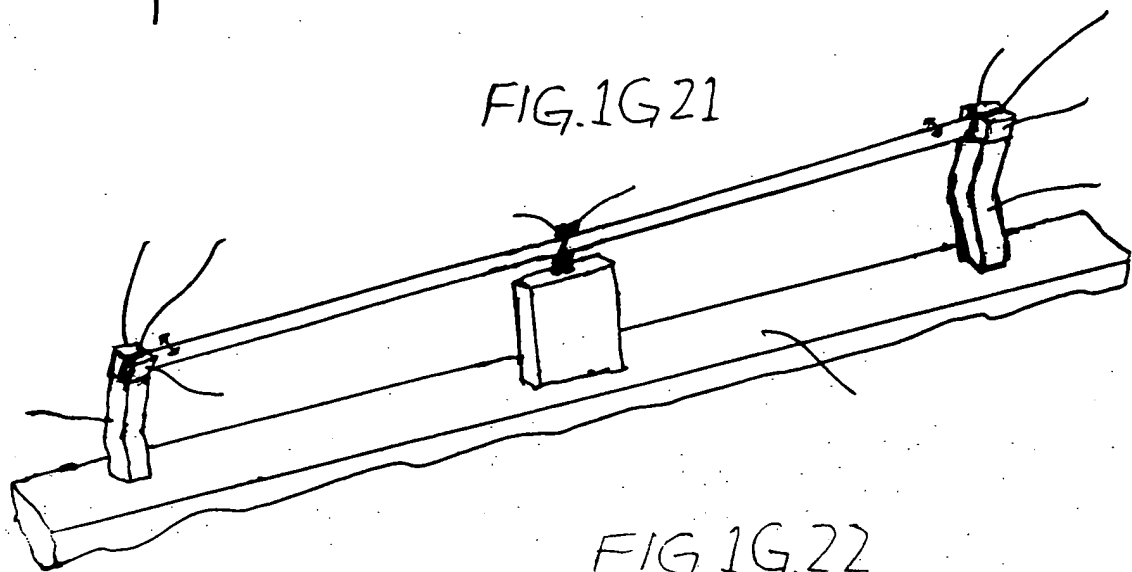
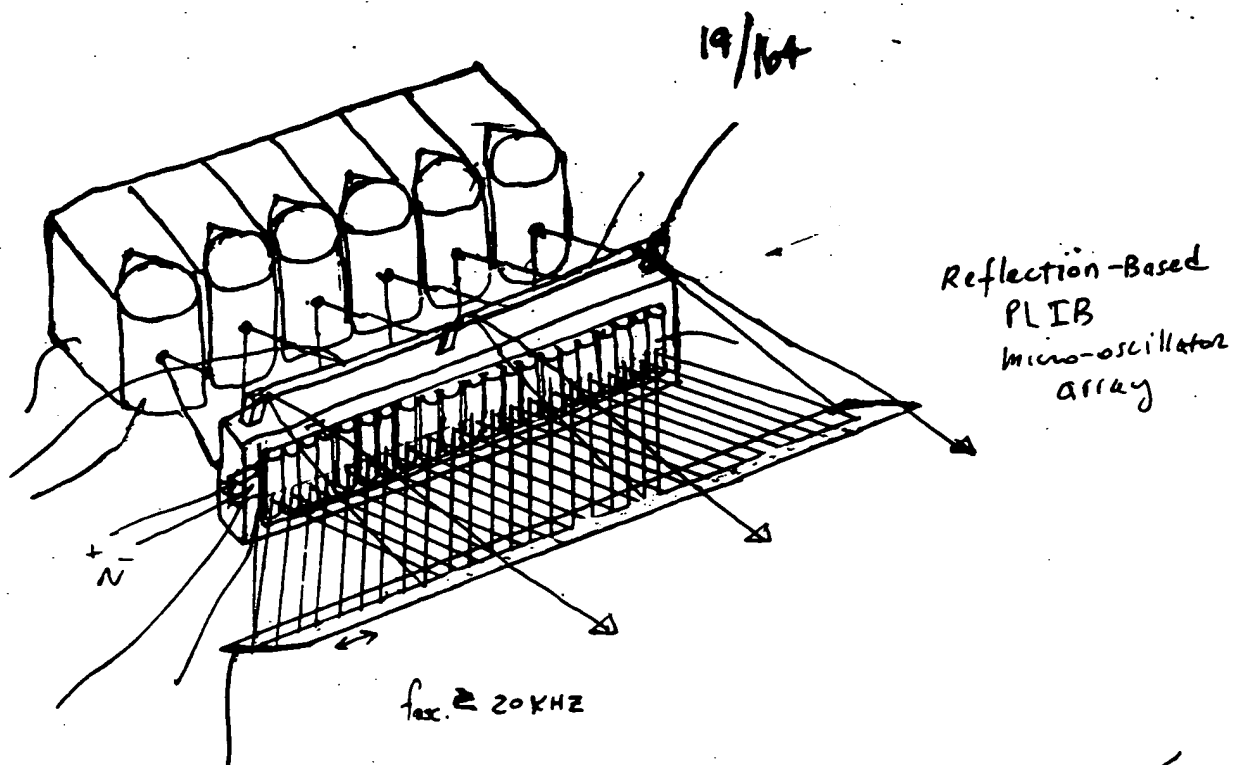


FIG. 1G.23

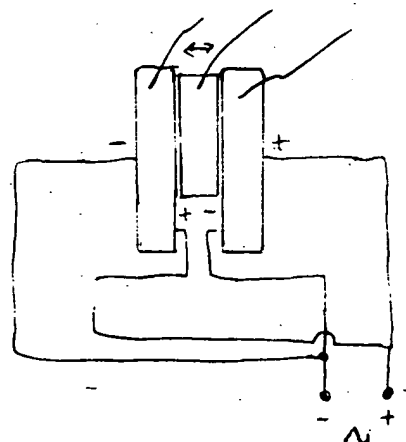


FIG. 1G.24

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Beam
Deflection
Control
Signals

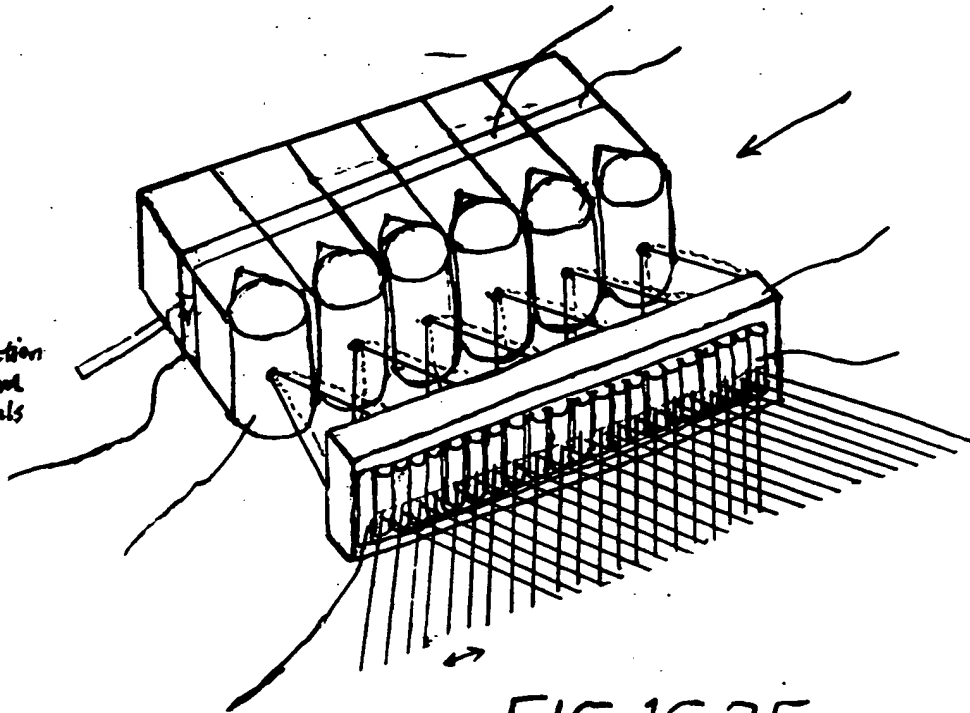


FIG. 1G25

Beam deflection
control signals
to Acousto-optic
Bragg Cells

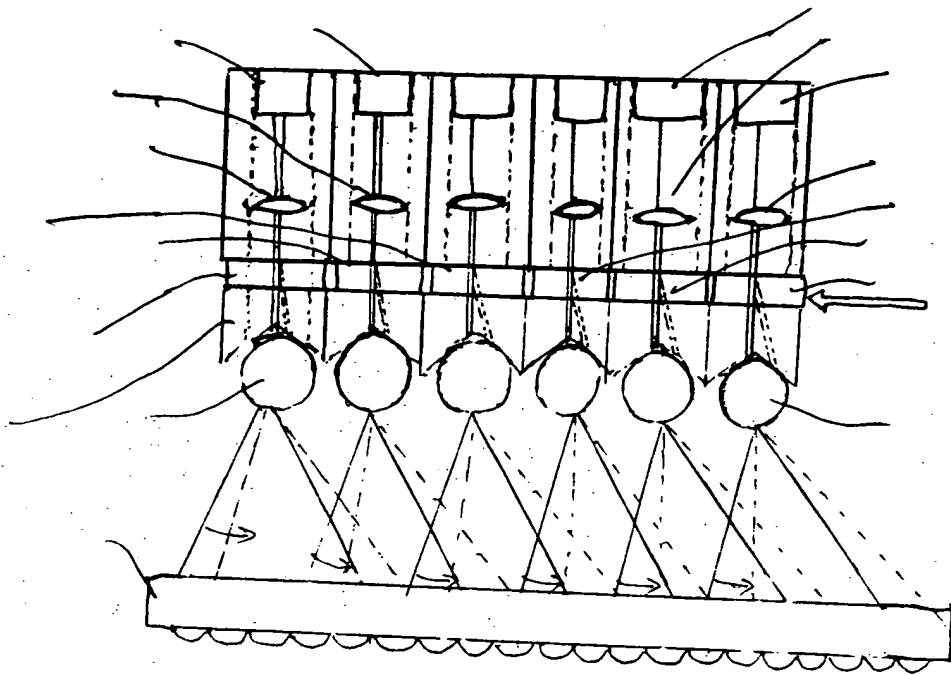


FIG. 1G26

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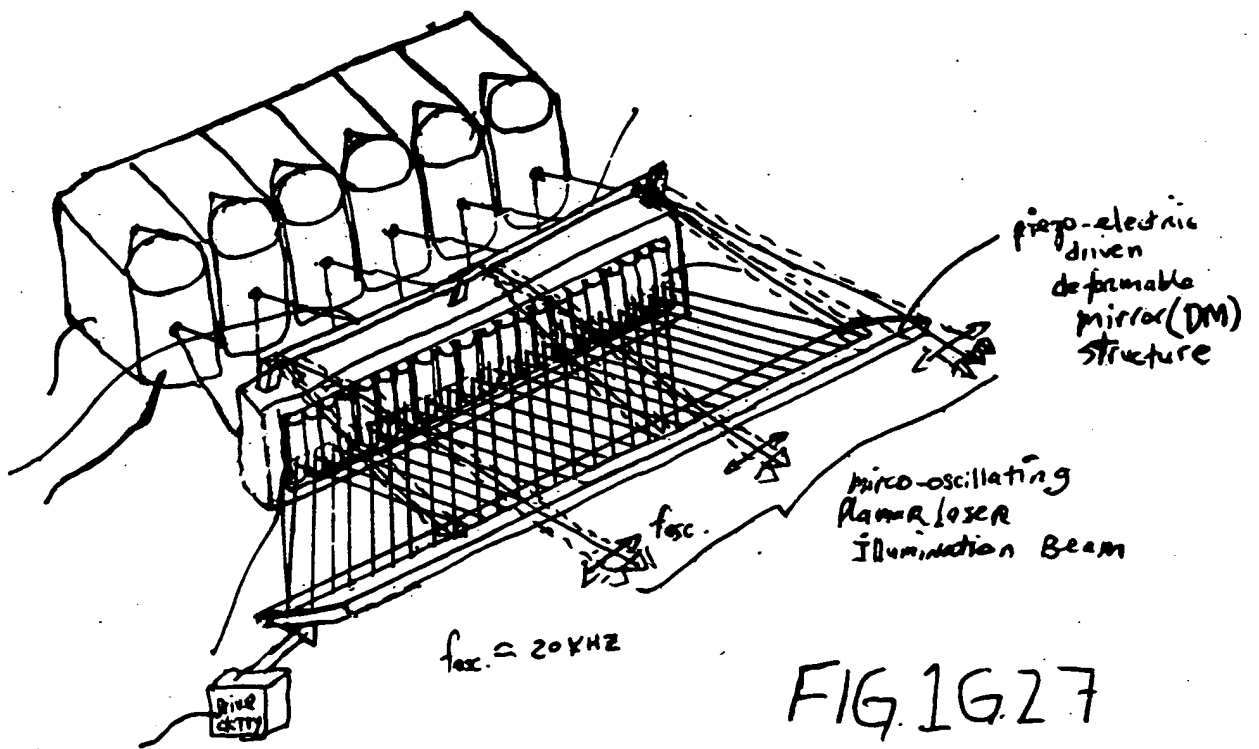


FIG. 16.27

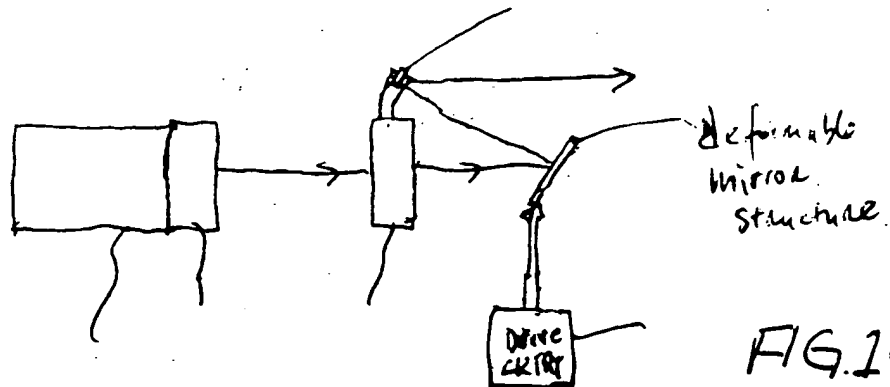
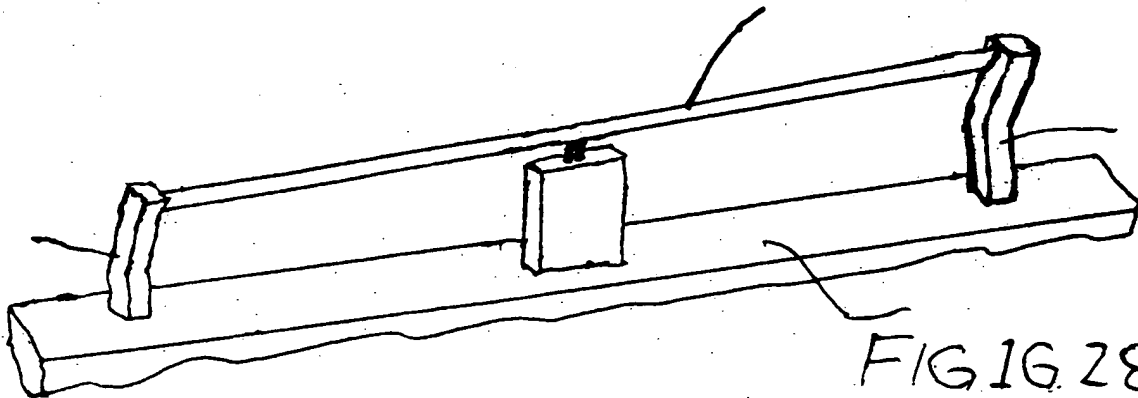


FIG. 16.29

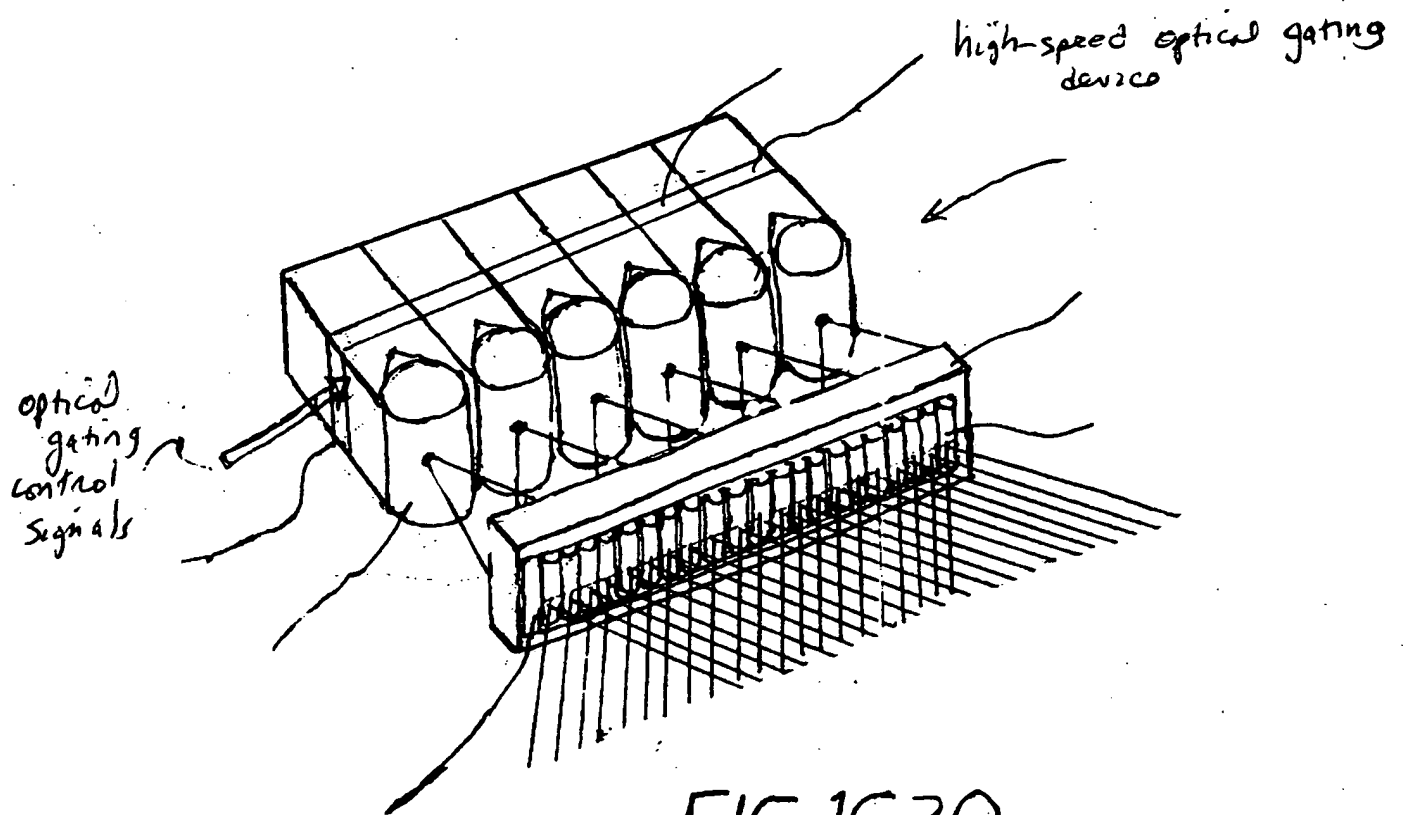


FIG. 1G30

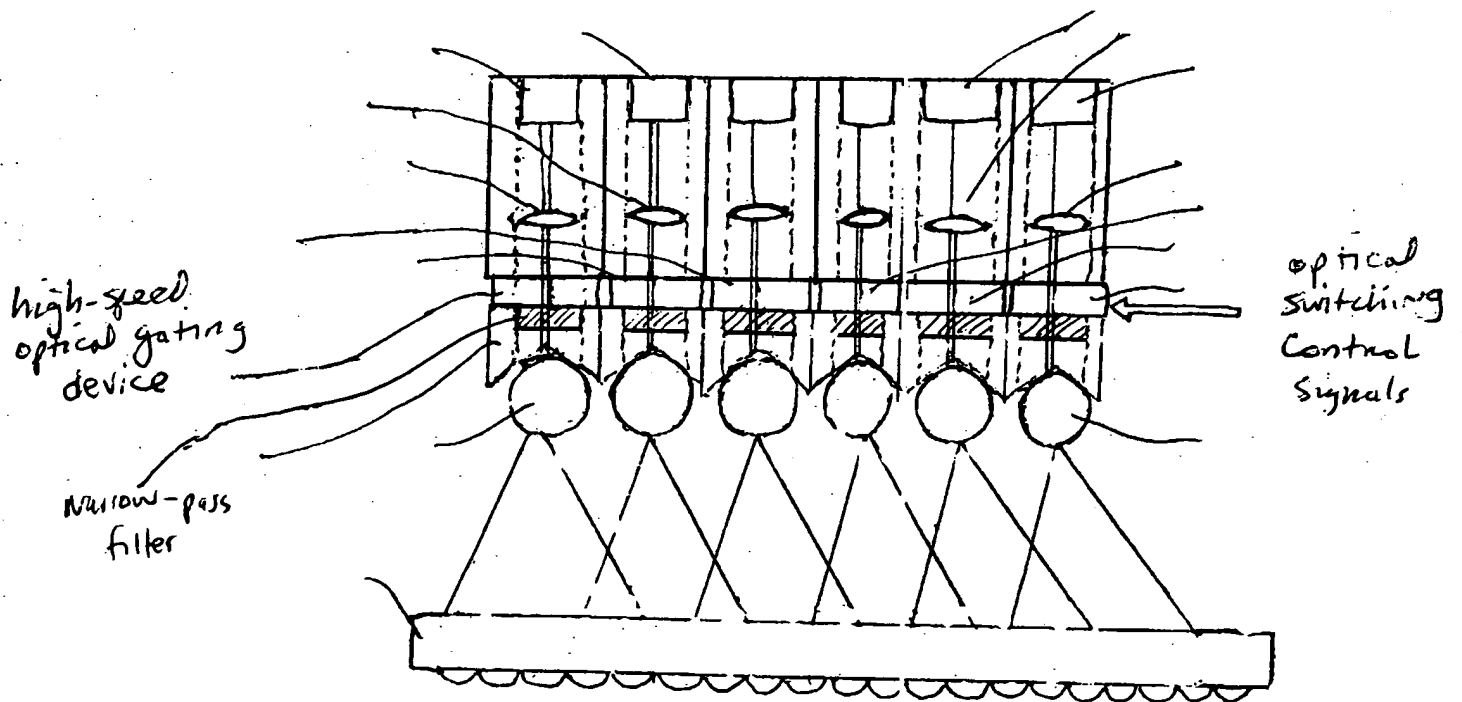


FIG. 1G31

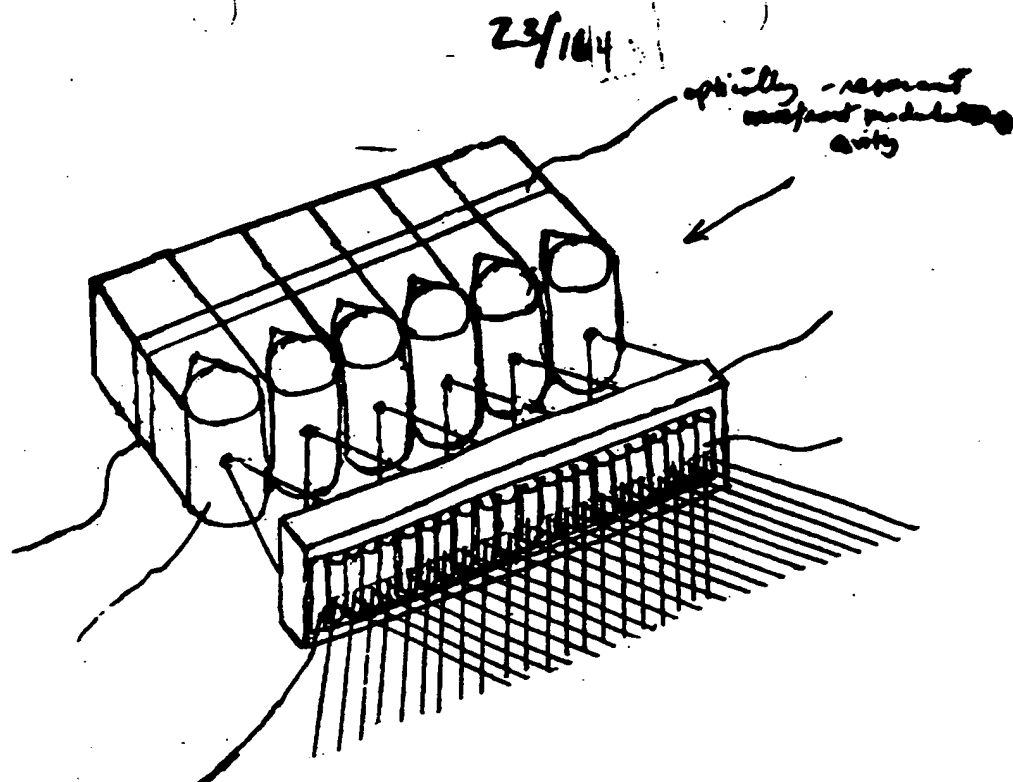


FIG 1G32

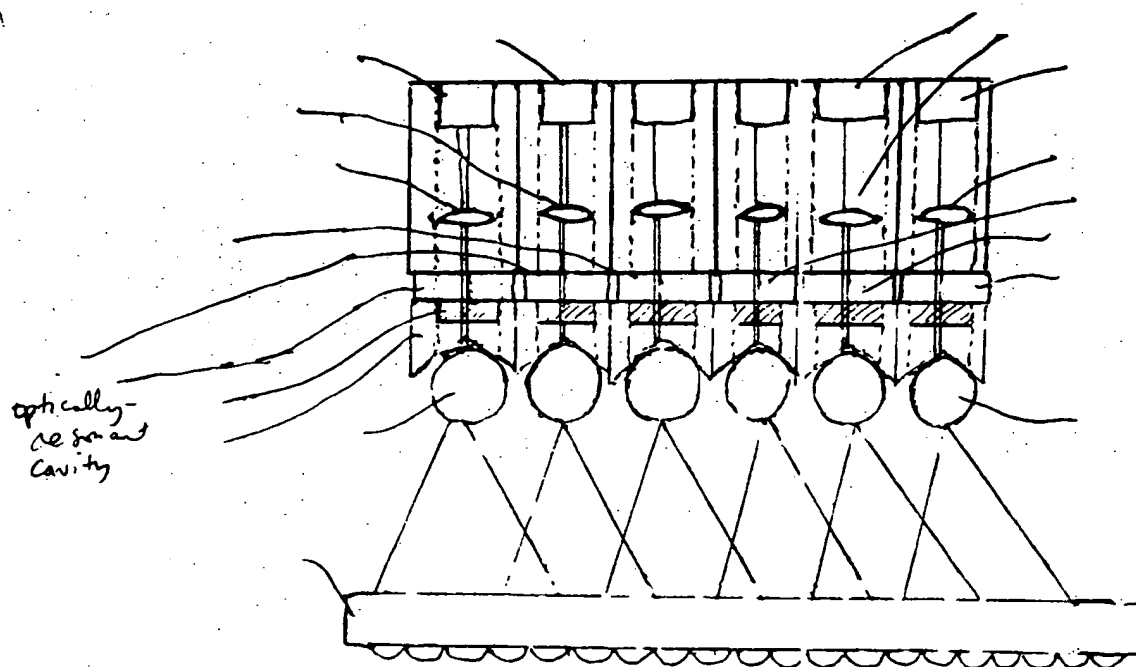


FIG 1G33

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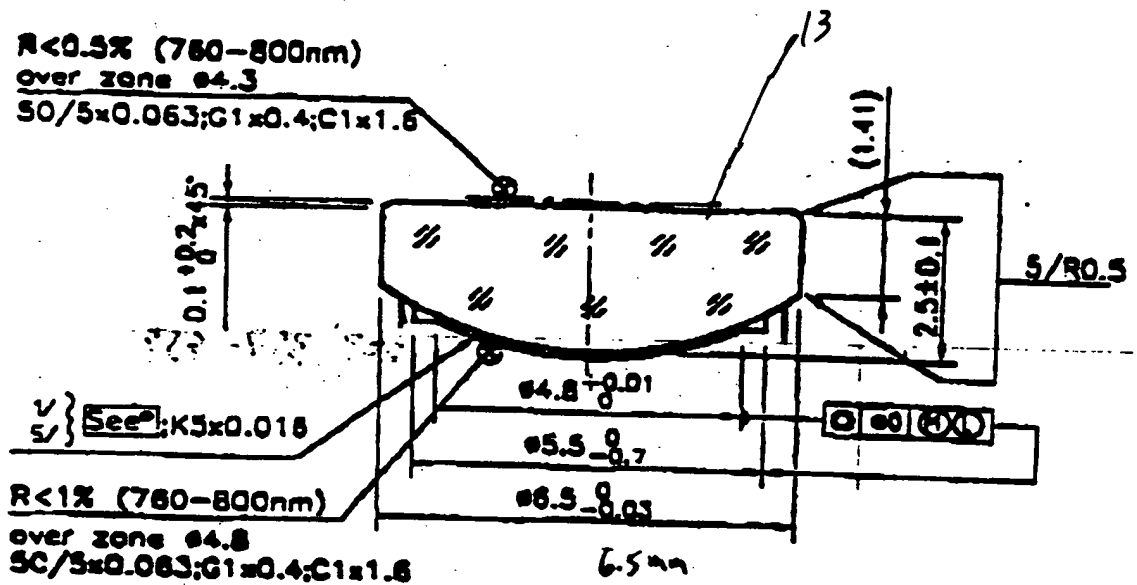


FIG. 1H1

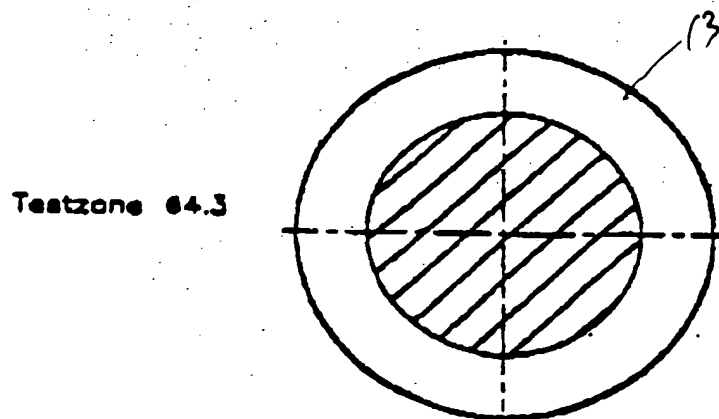


FIG. 1H2

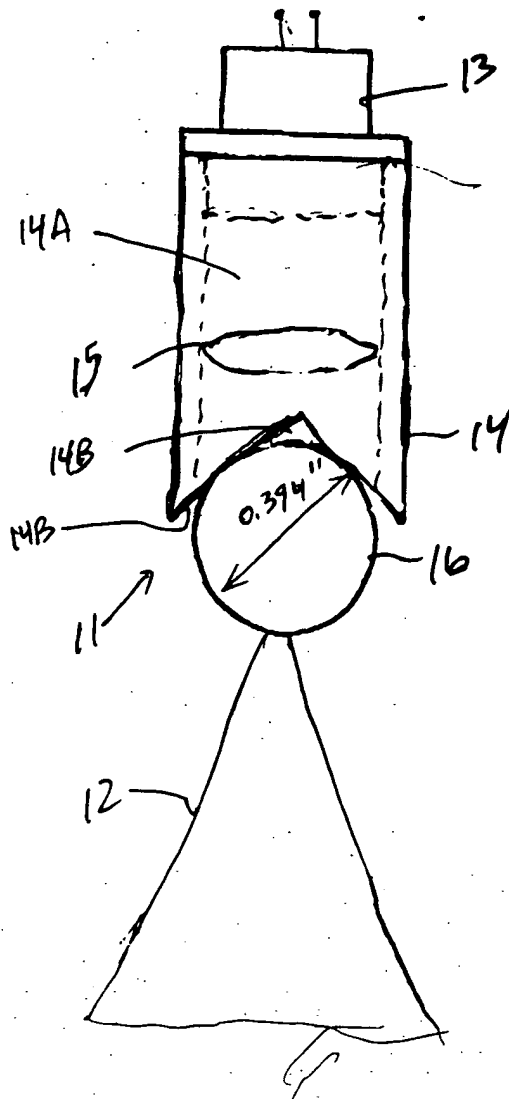


FIG 1I1

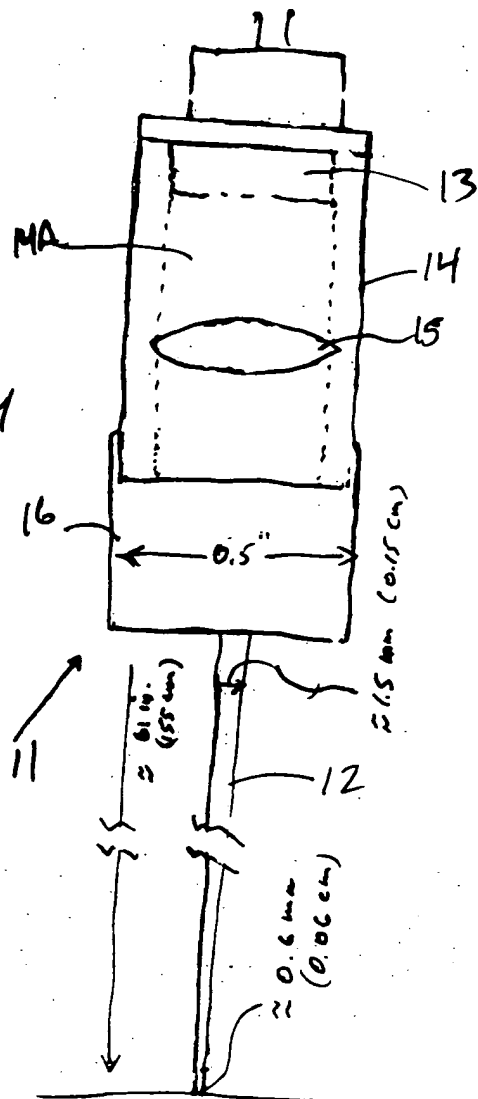


FIG 1I2

furthest
object/working
distance

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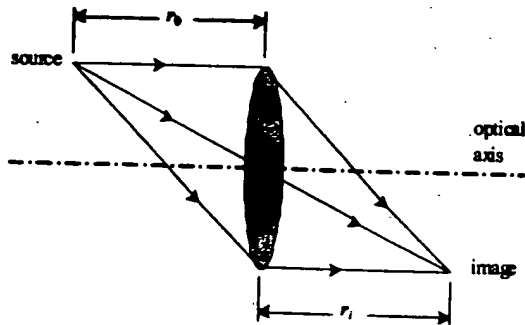


FIG. 1J1

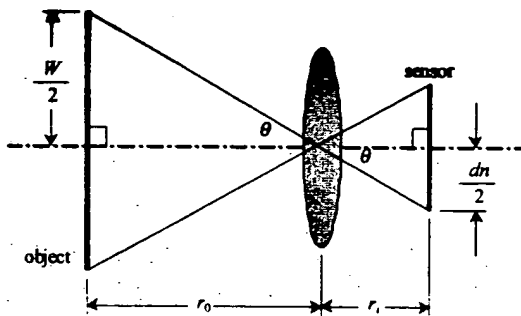


FIG. 1J2

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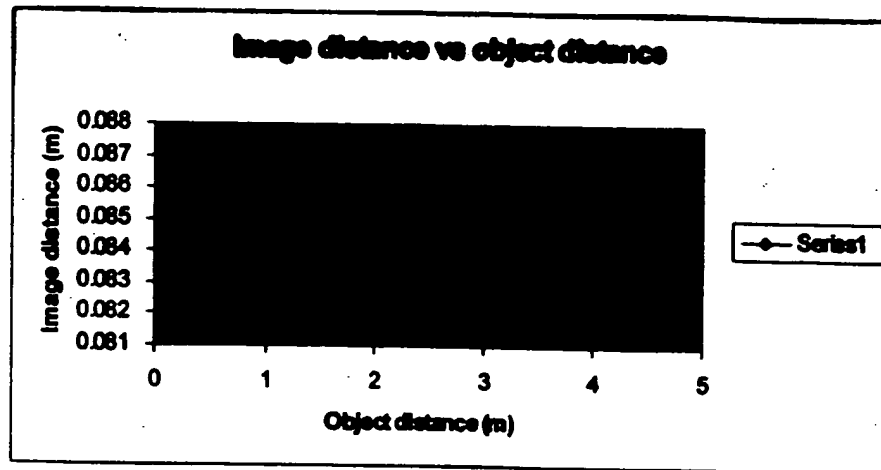


FIG. 1J3

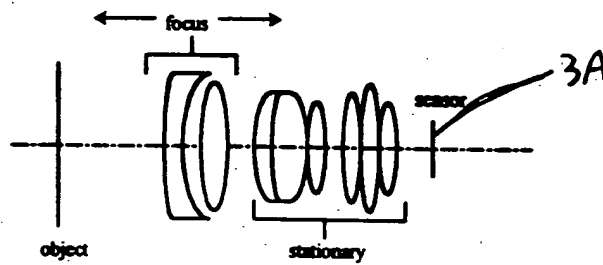


FIG. 1J4

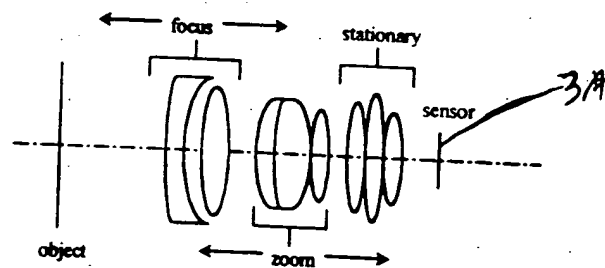
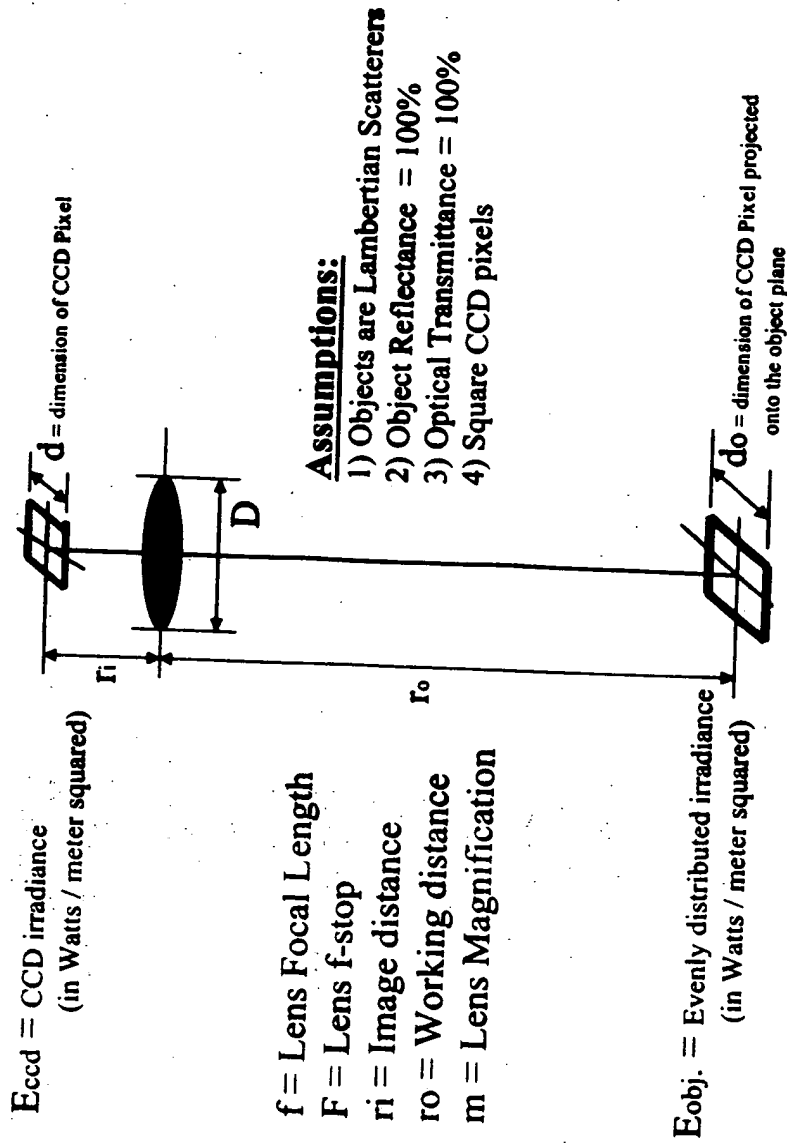


FIG. 1J5

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CCD-Based Scanner

FIG. 1J6

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Fixed focal length lens
cases

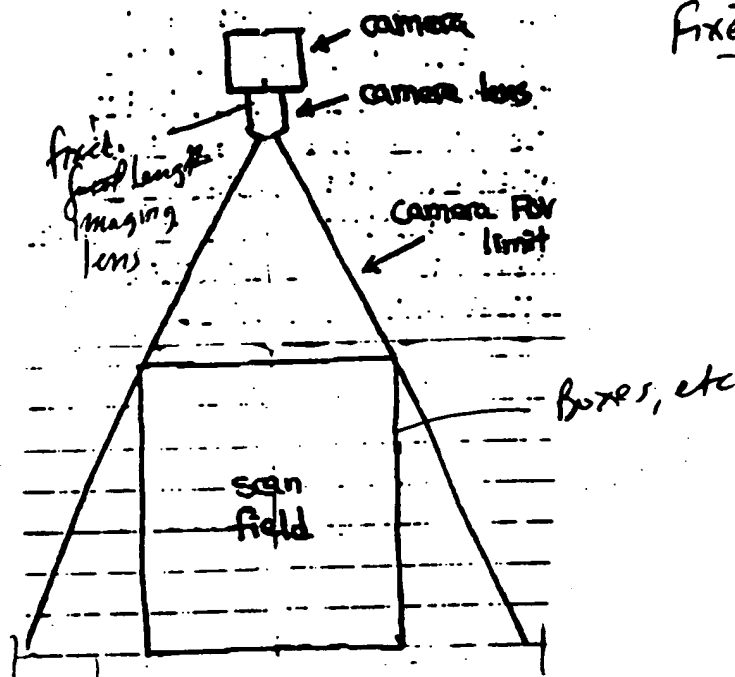
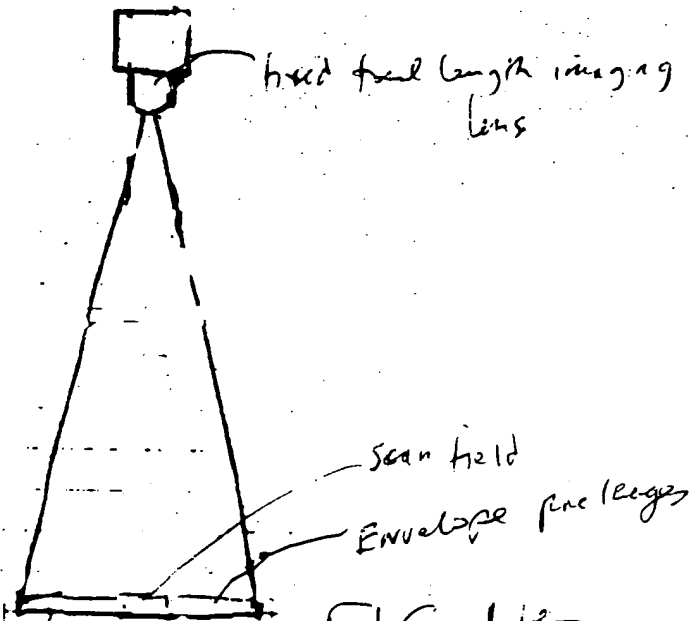


FIG 1K1
envelope 34



envelope
34

FIG 1K2

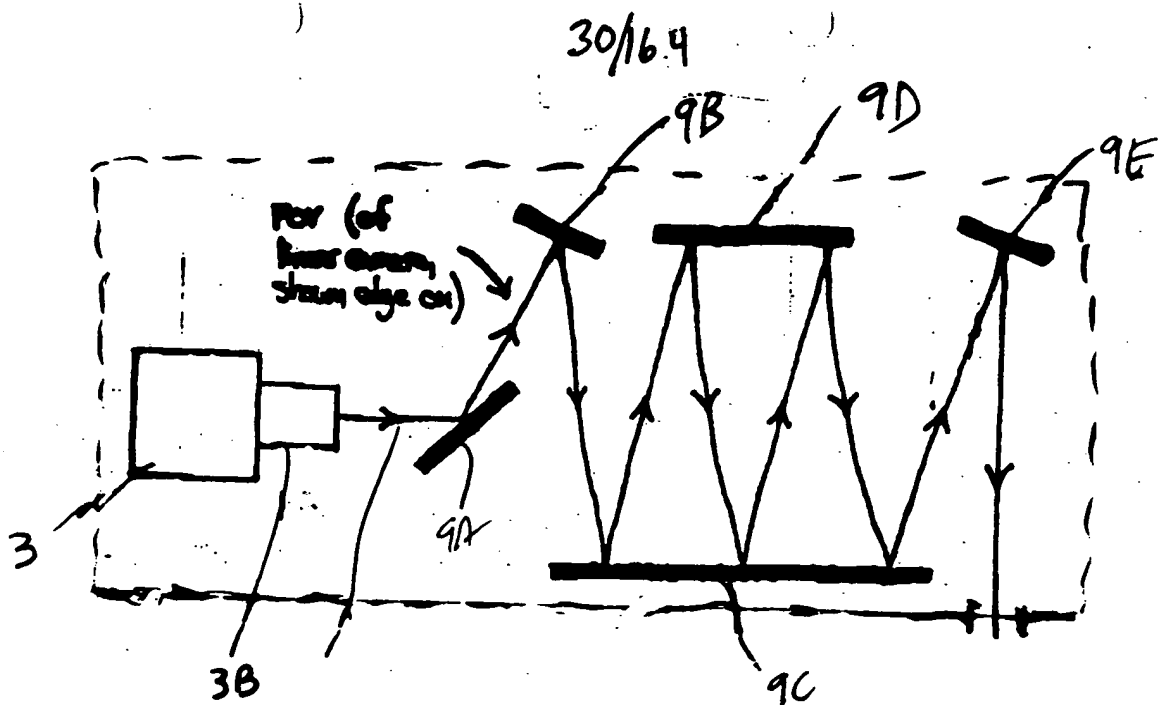


FIG. 1L1

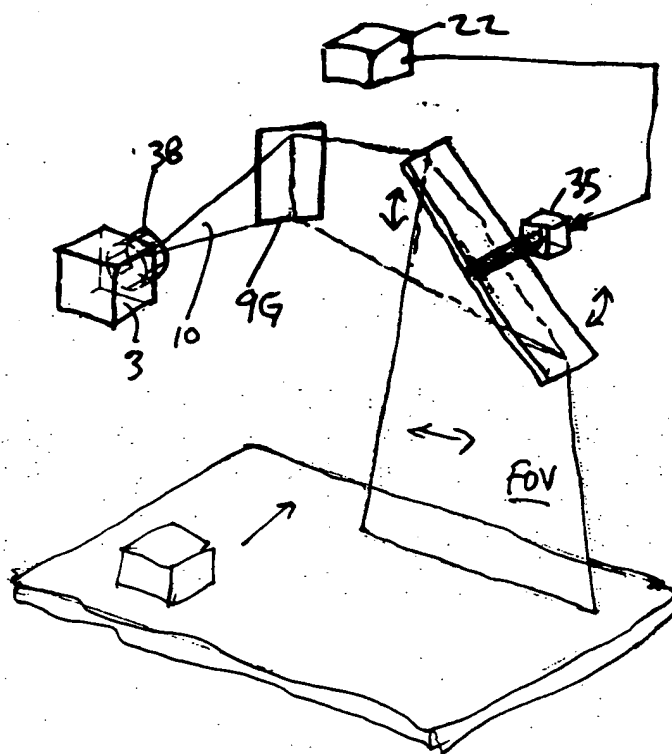


FIG. 1L2

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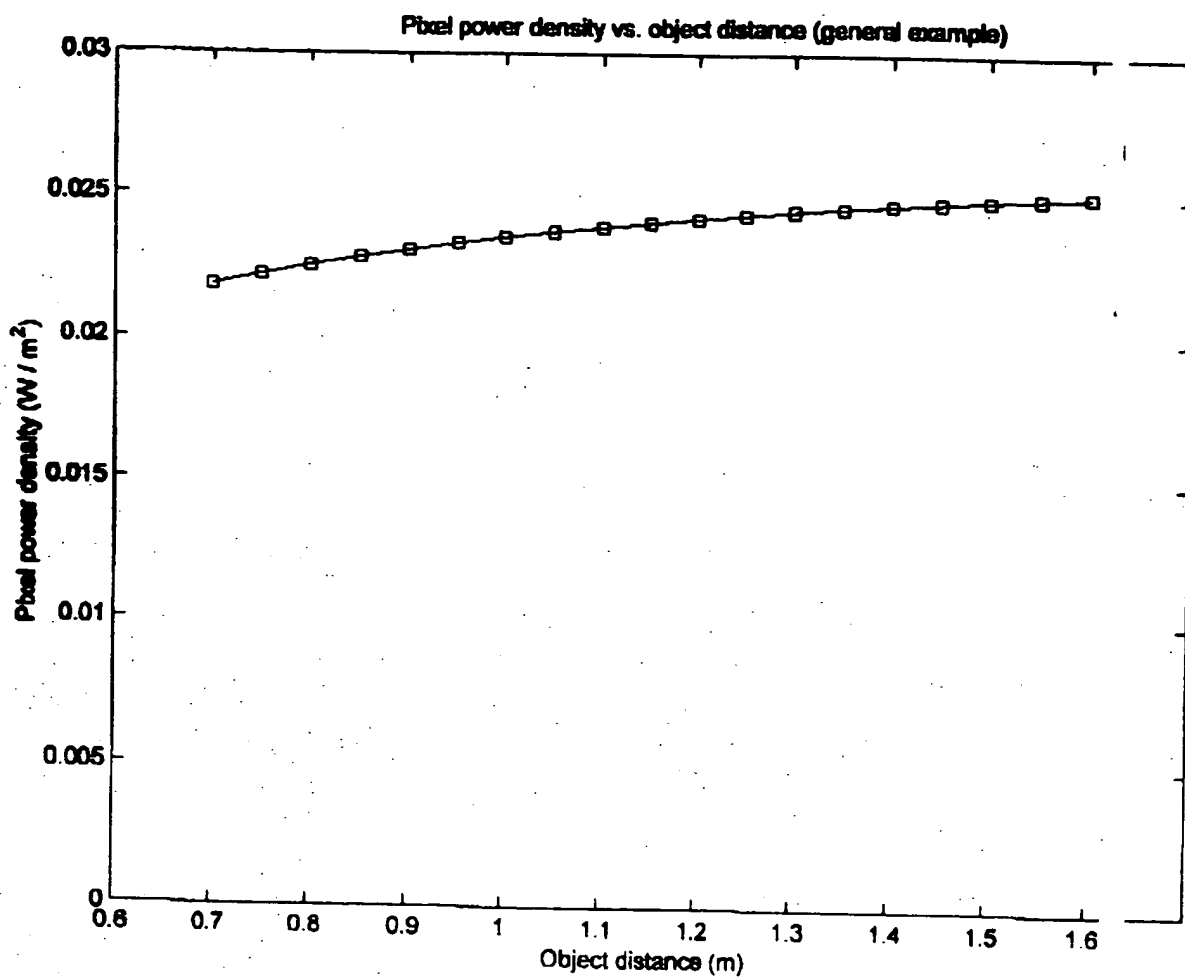


FIG-1M1

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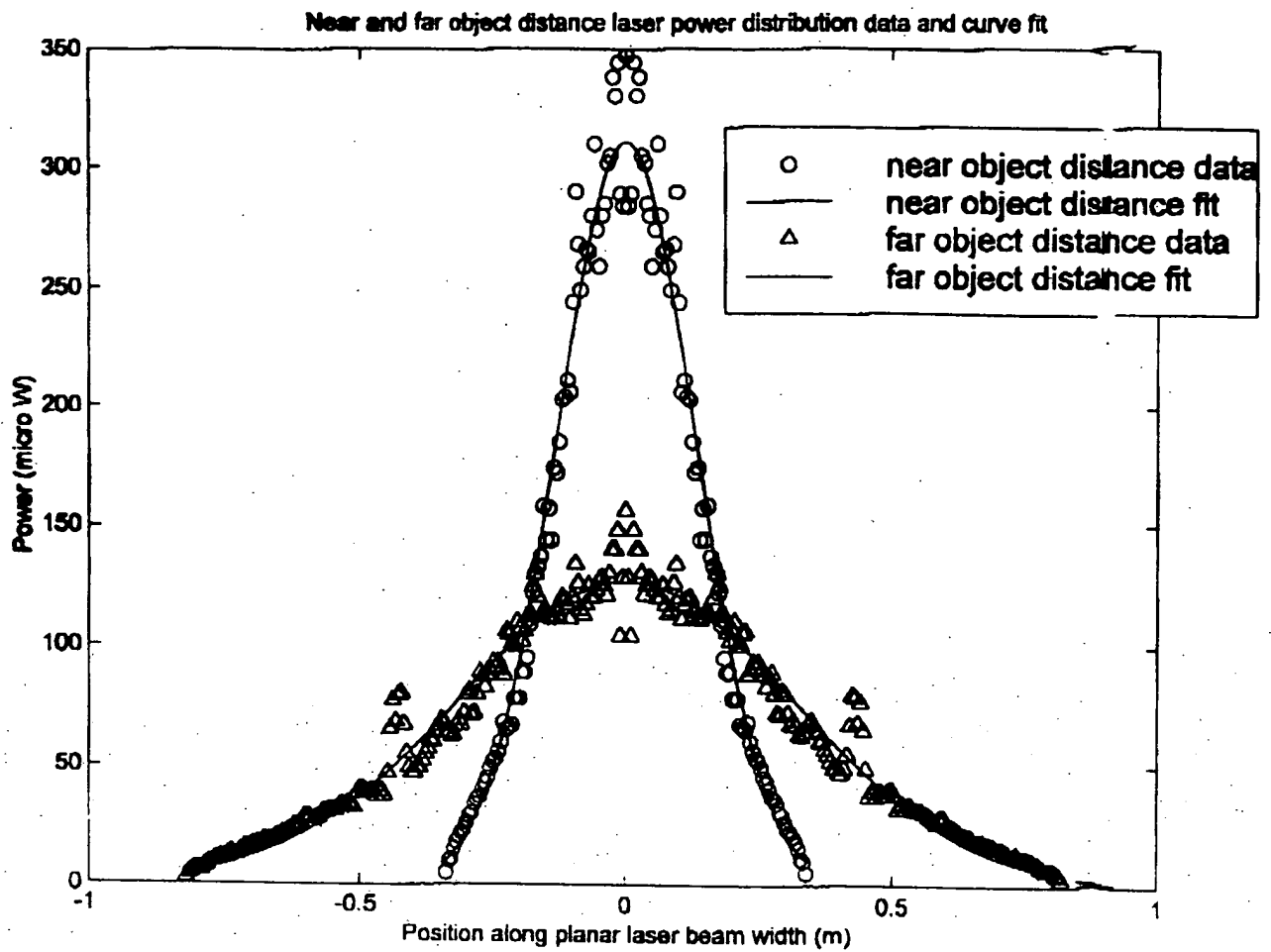


FIG. 1M2

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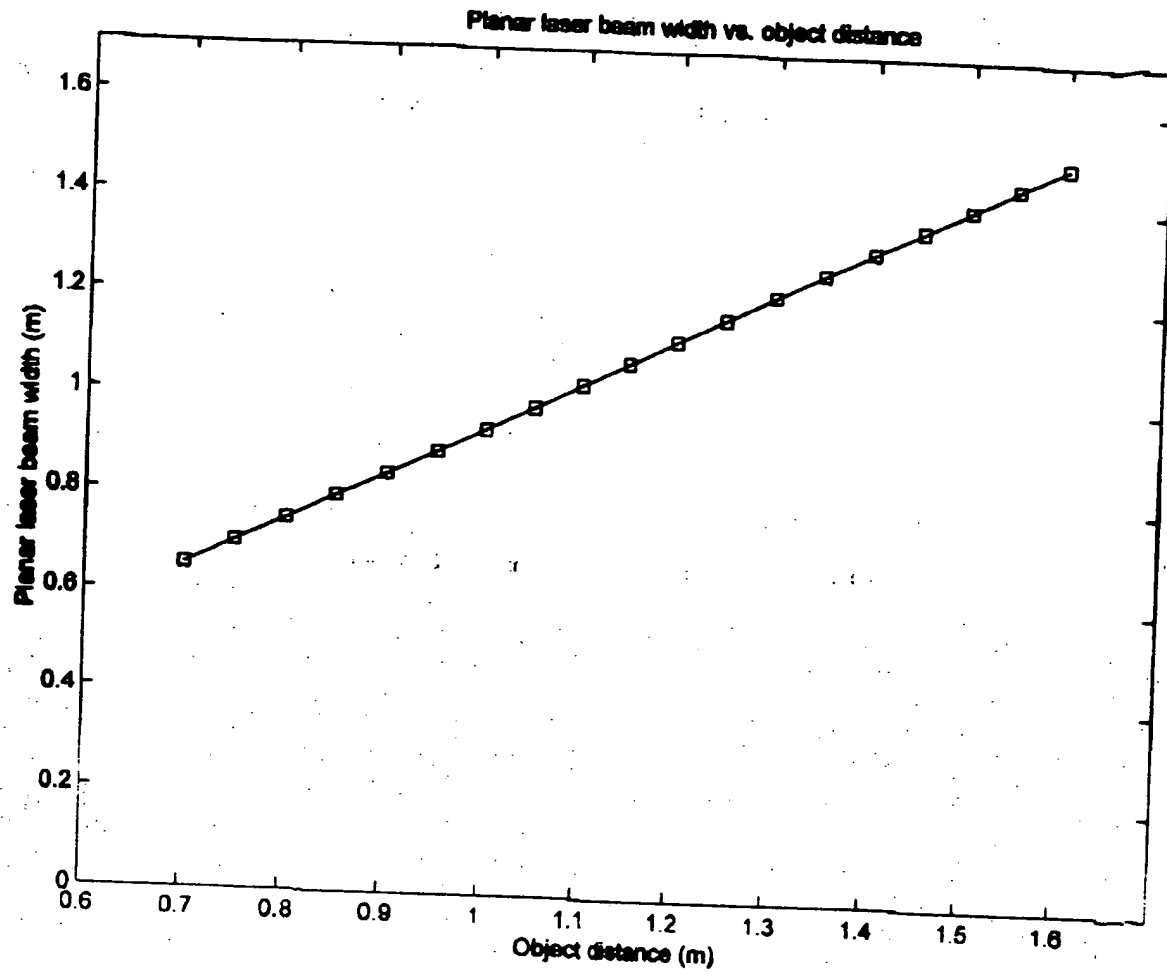


FIG. 1M3

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Figure 4: Planar laser beam height vs. object distance (far object distance focus)

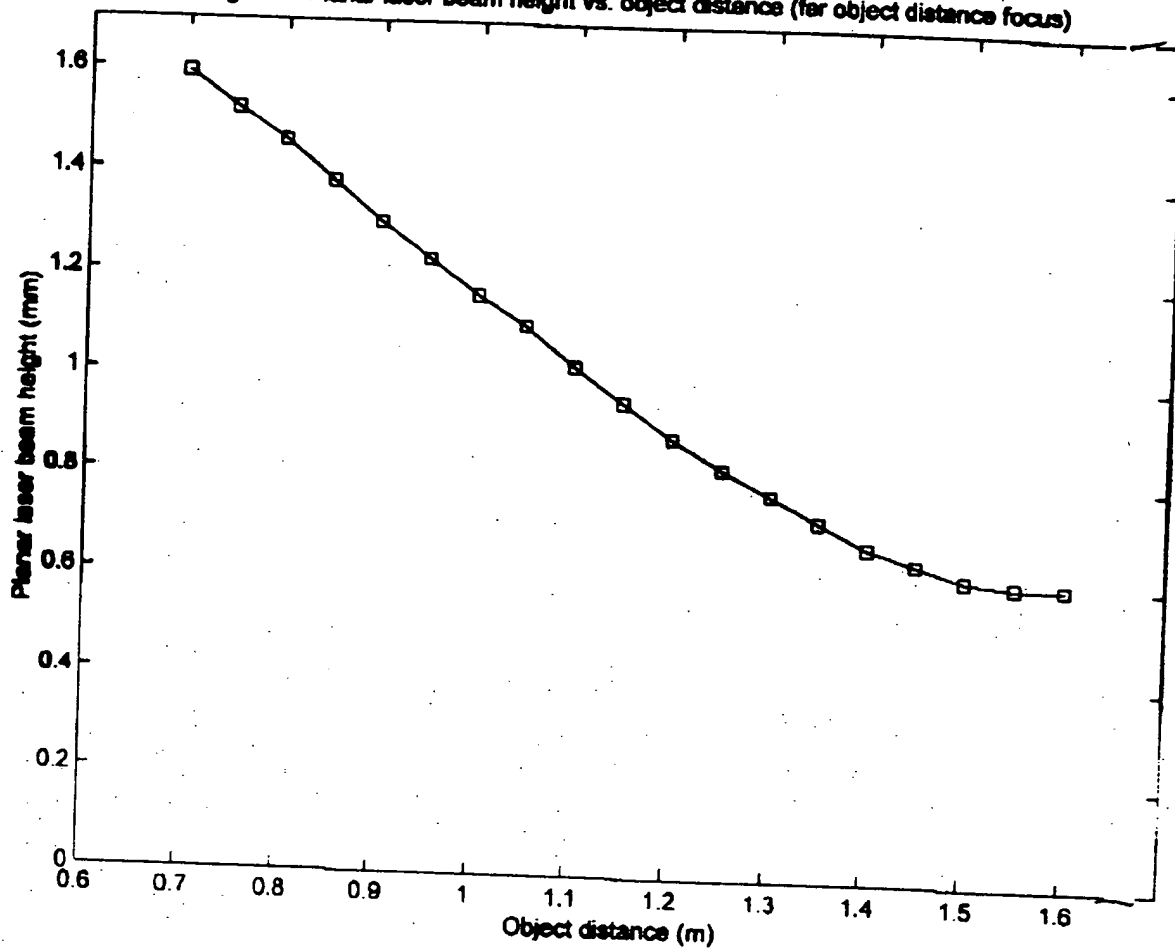


FIG 1M4

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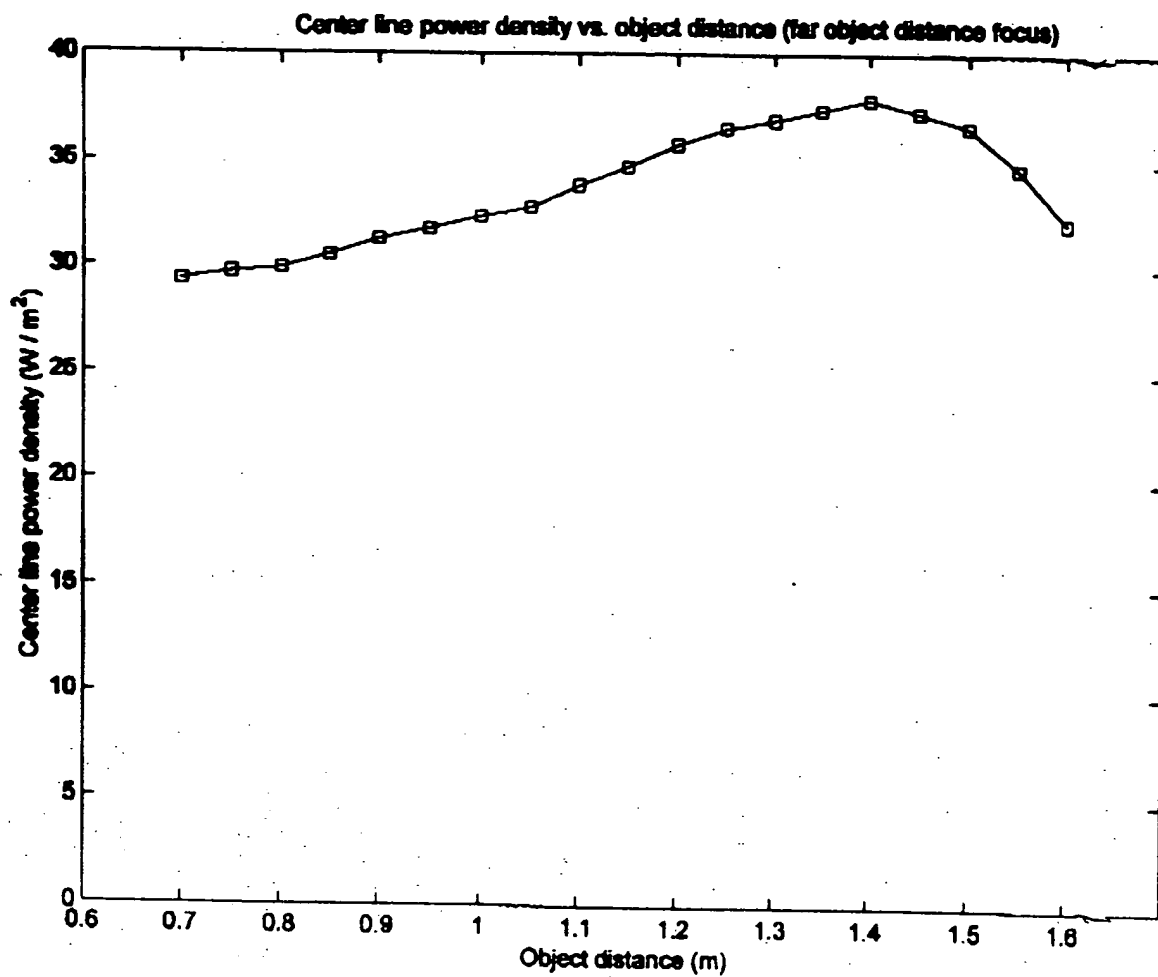


FIG. 1N

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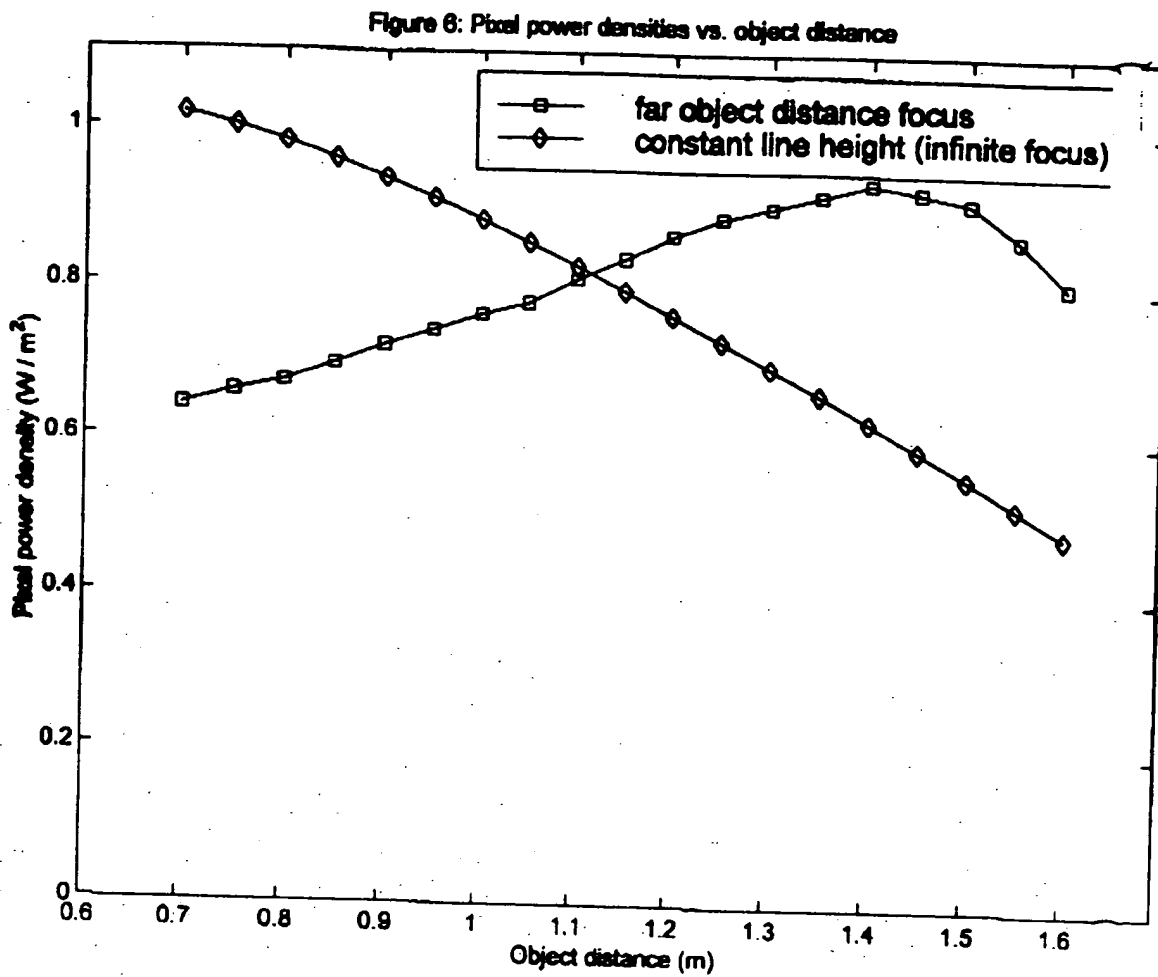


FIG 10

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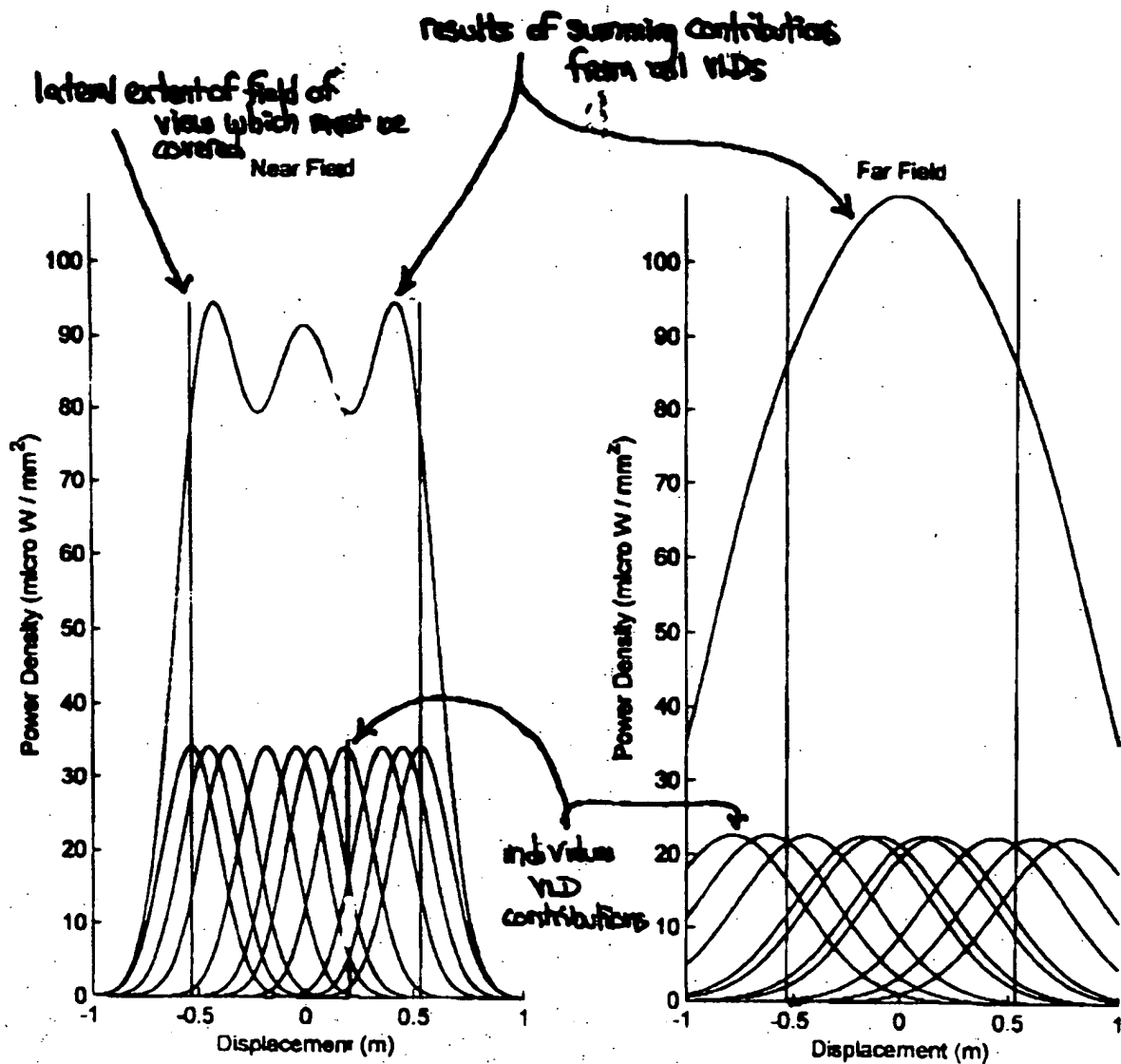


FIG 1P1

FIG 1P2

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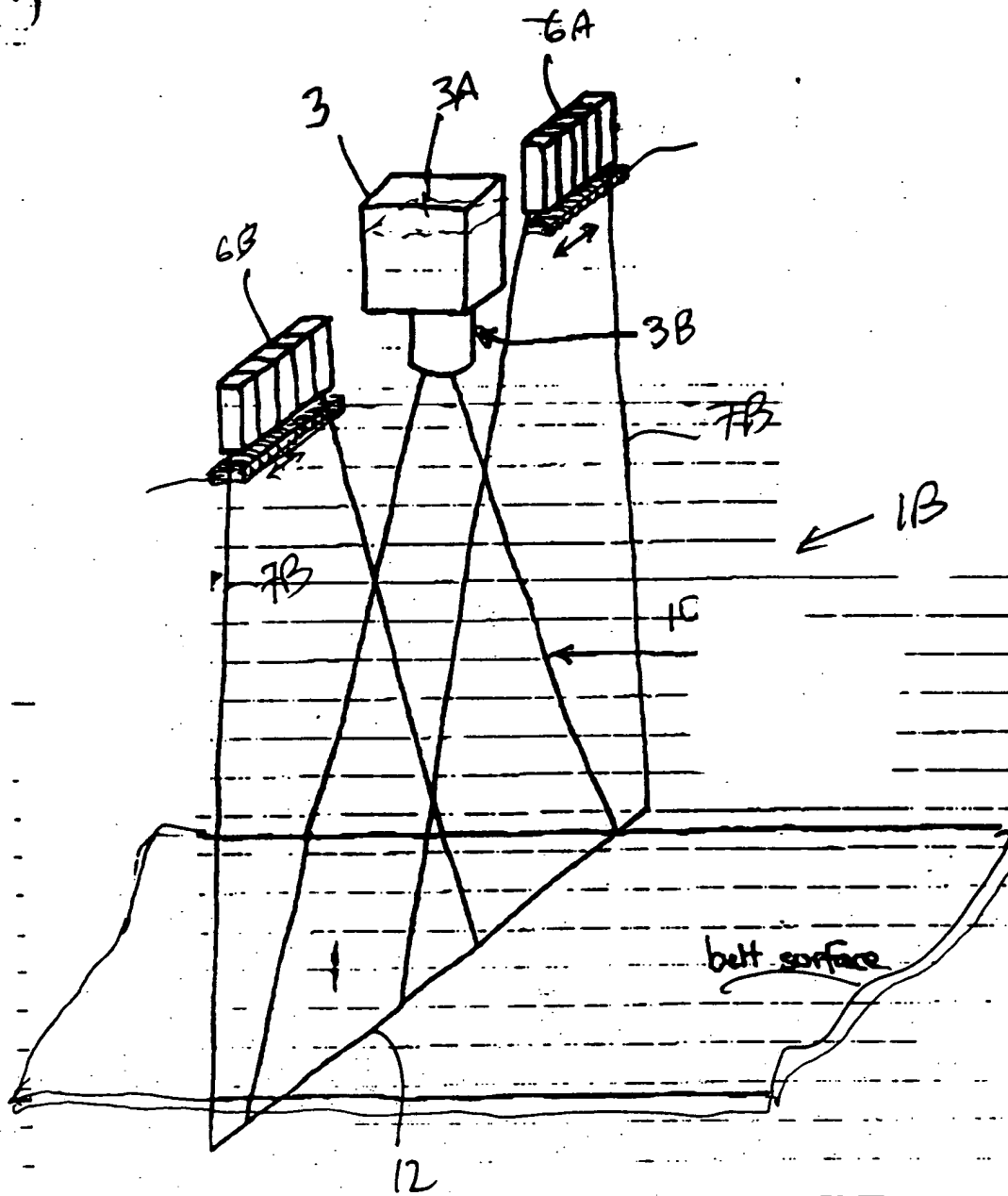


FIG. 1Q1

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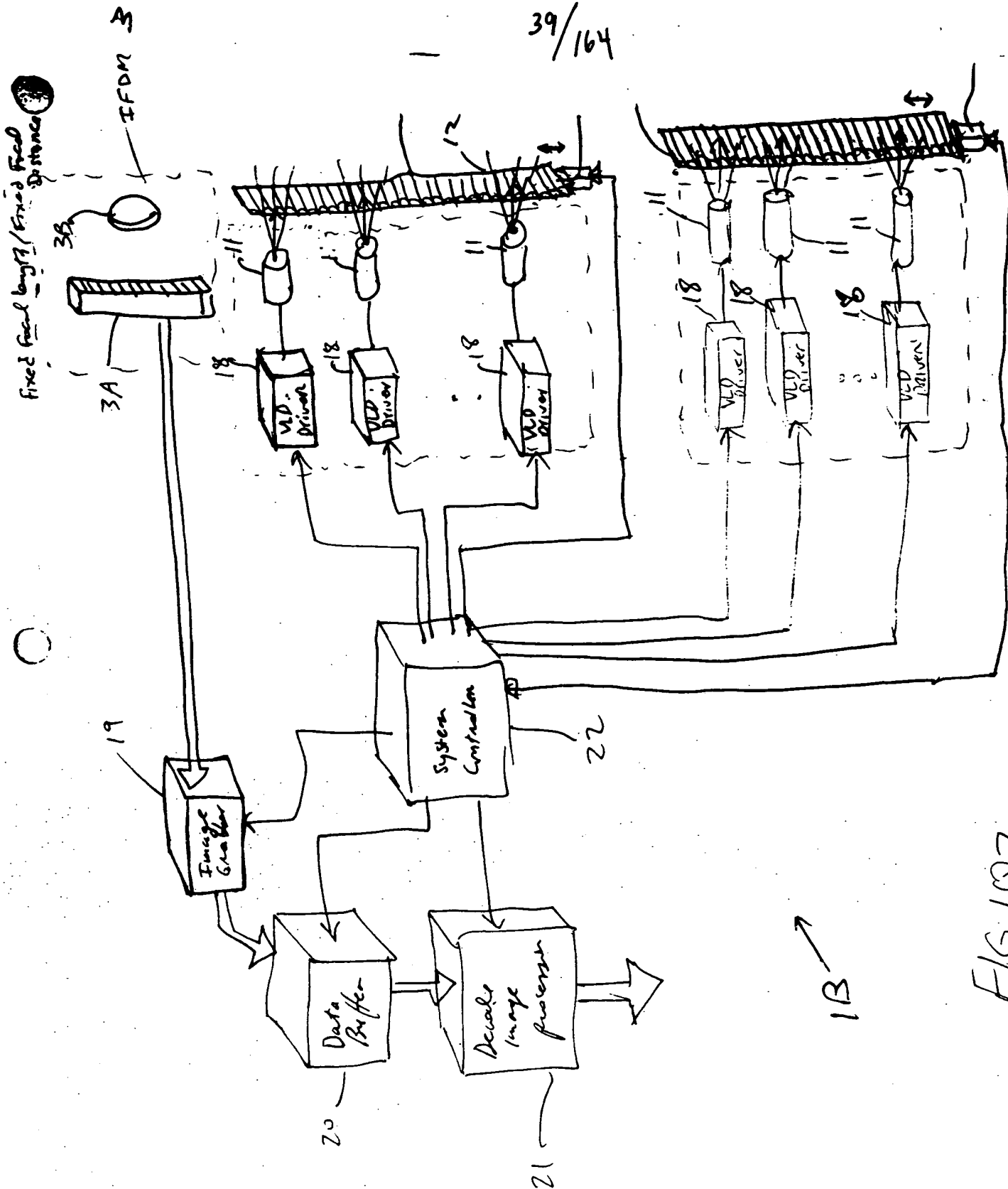
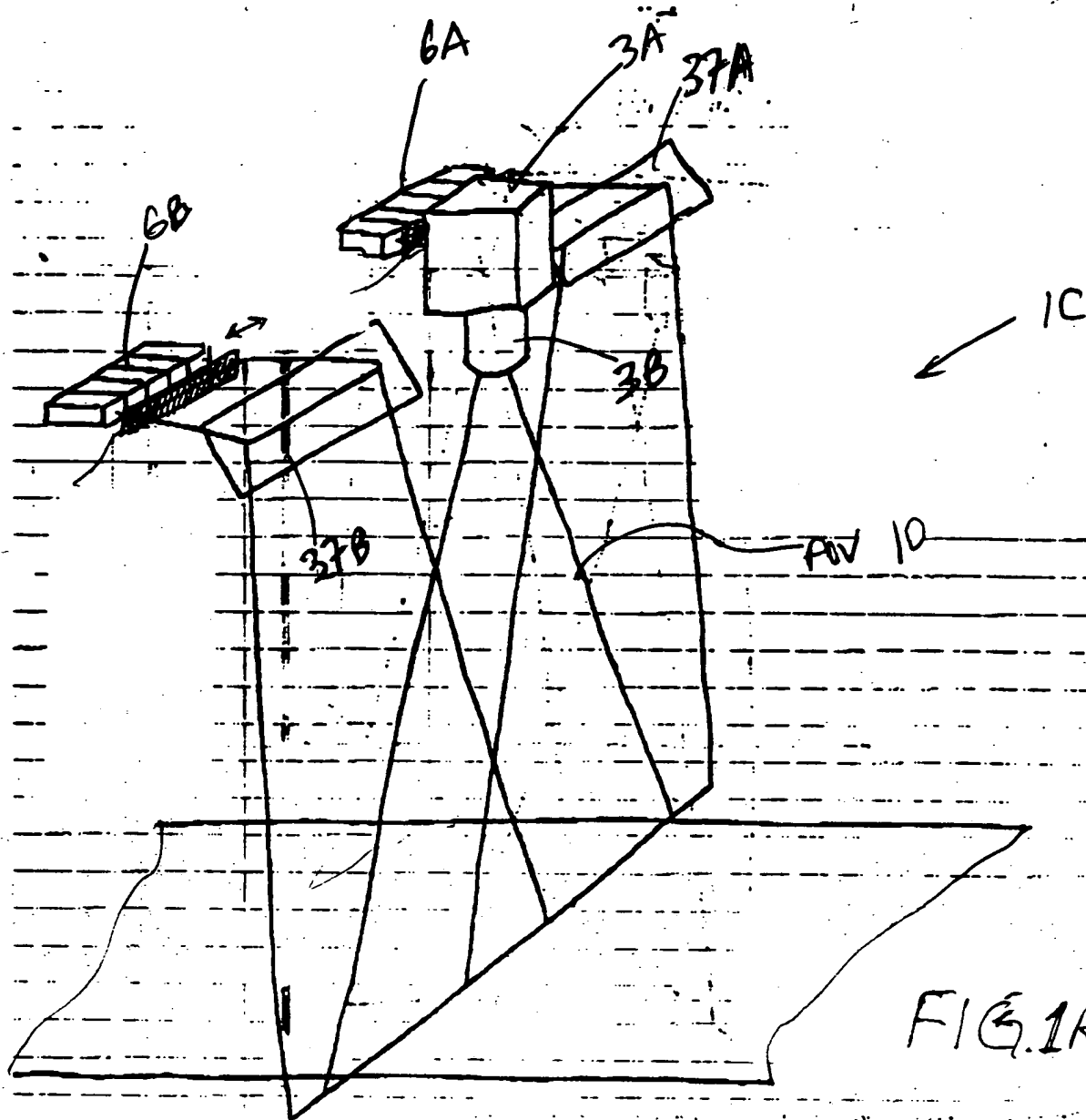


FIG. 102

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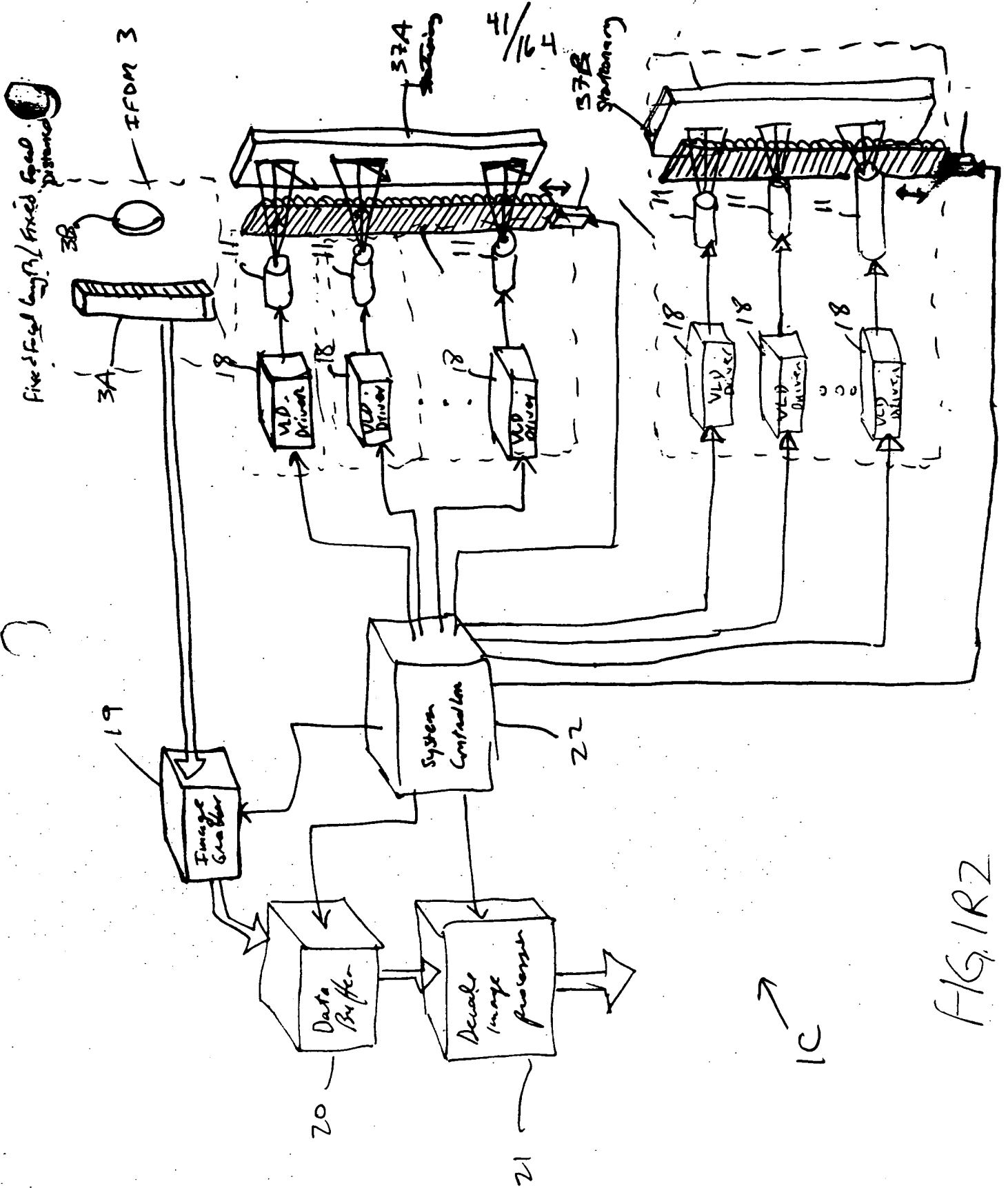


FIG. 1R2

IC

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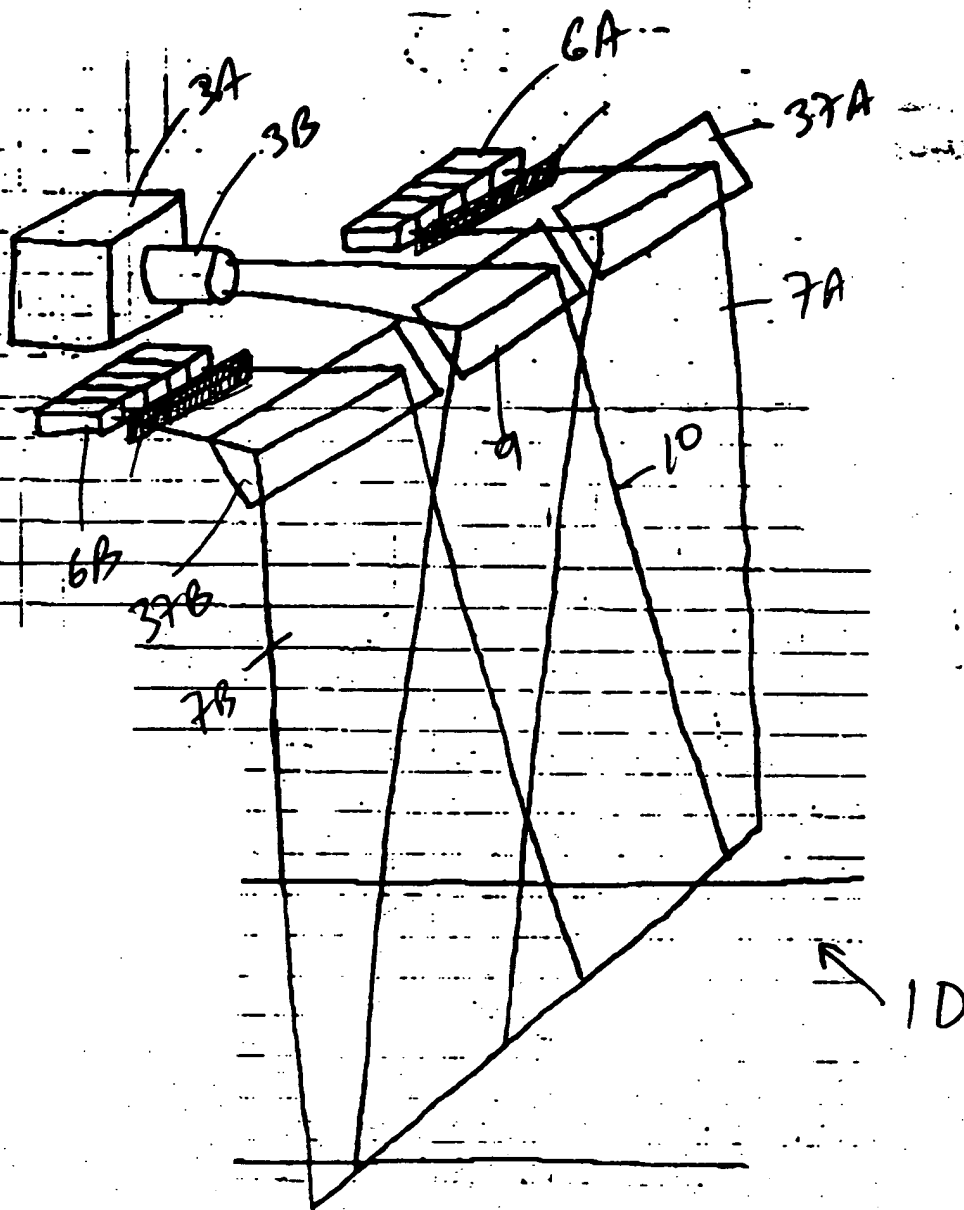
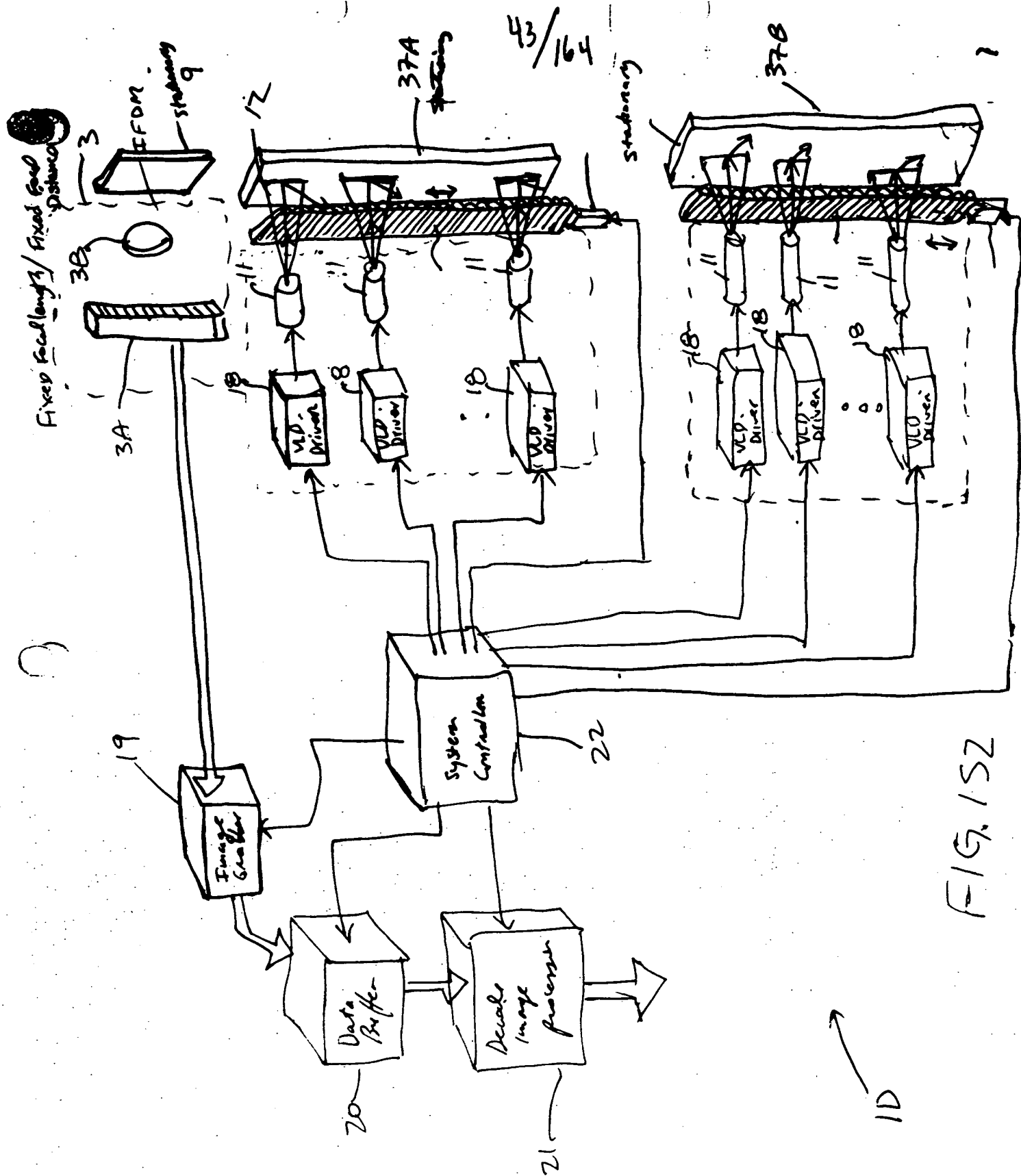


FIG. 151



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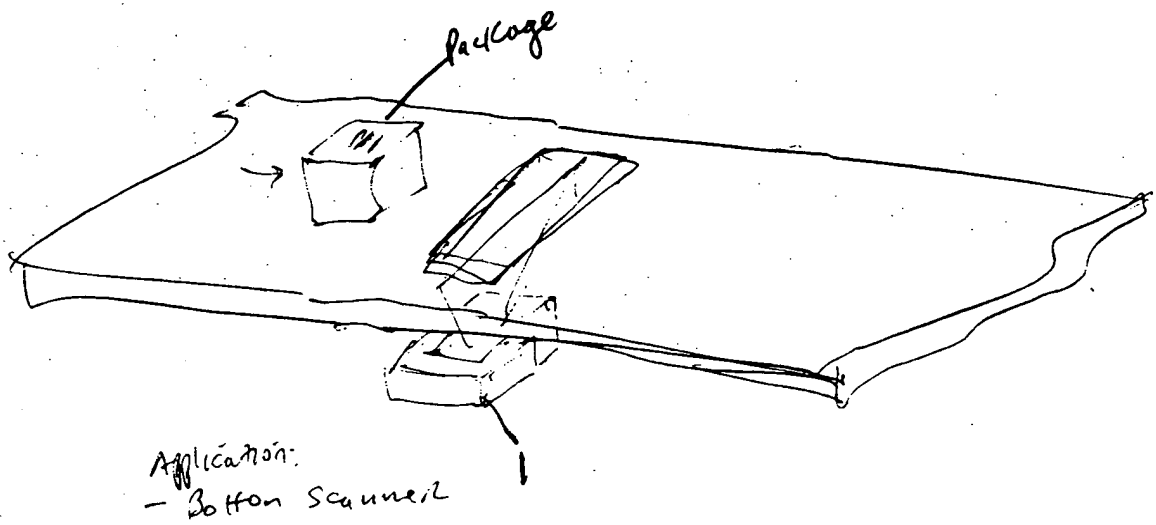


FIG 1T

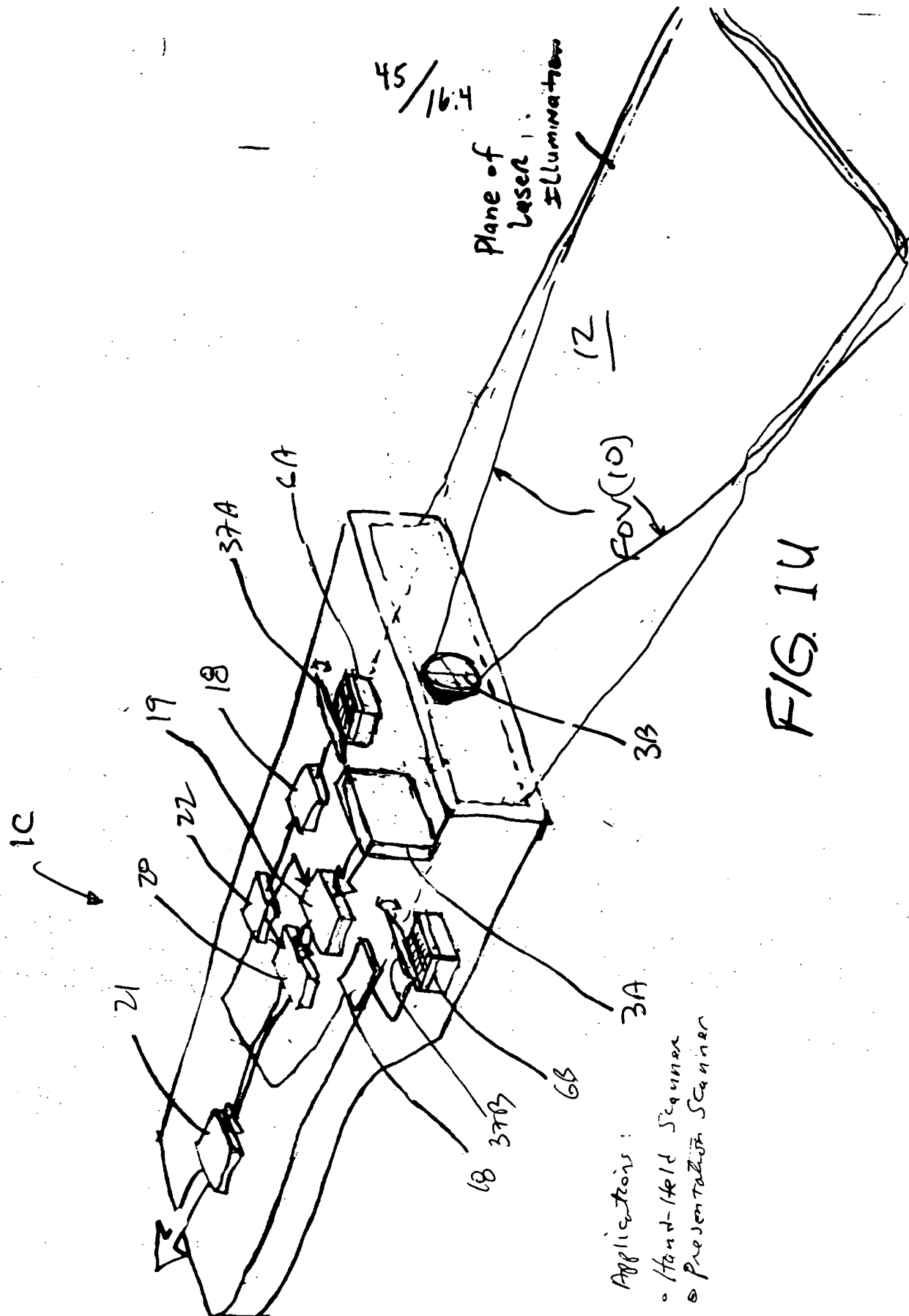


FIG. 14

Applications:

- Hand-Held Scanner
- Presentation Scanner

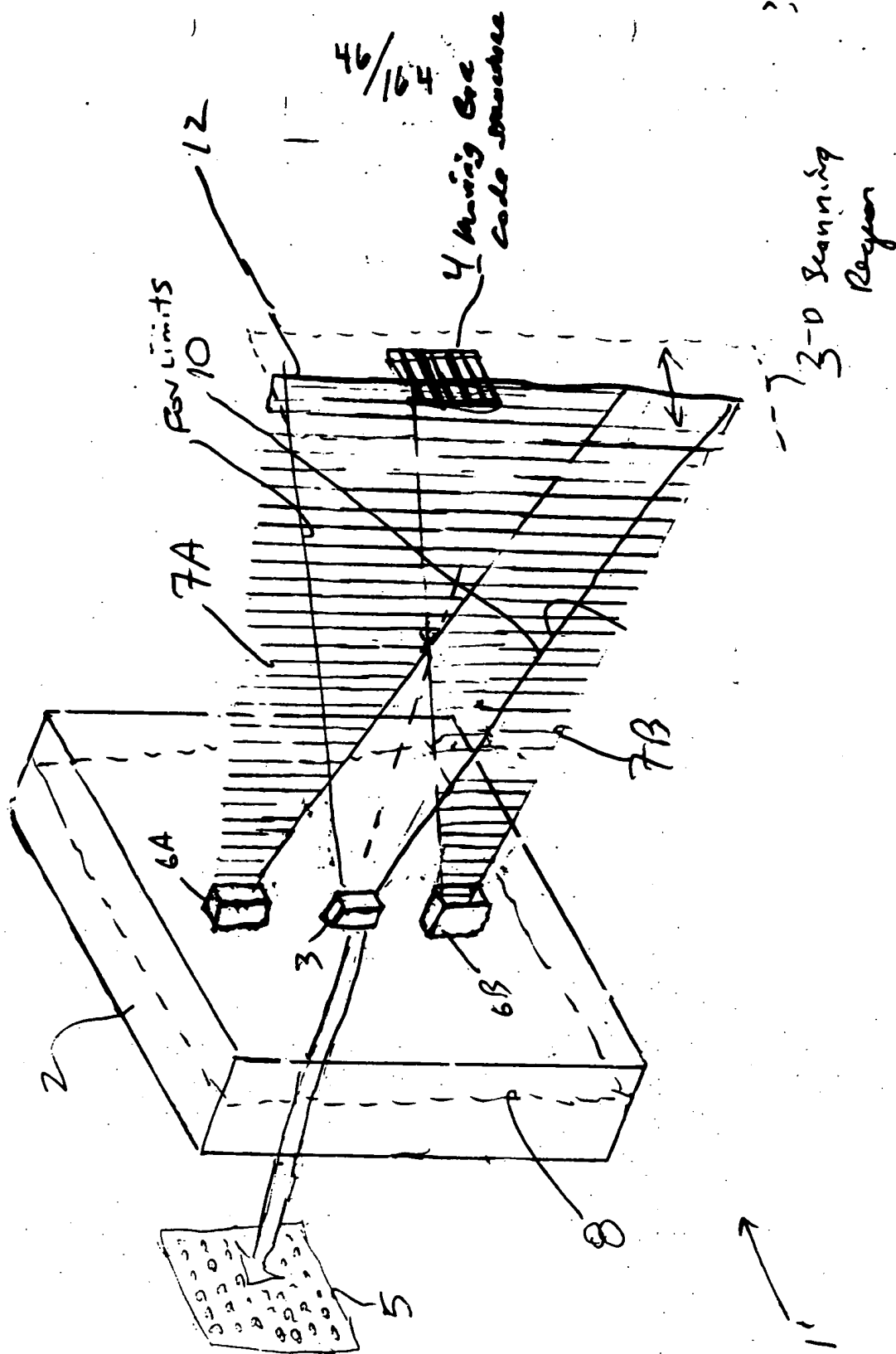


FIG. 1VI

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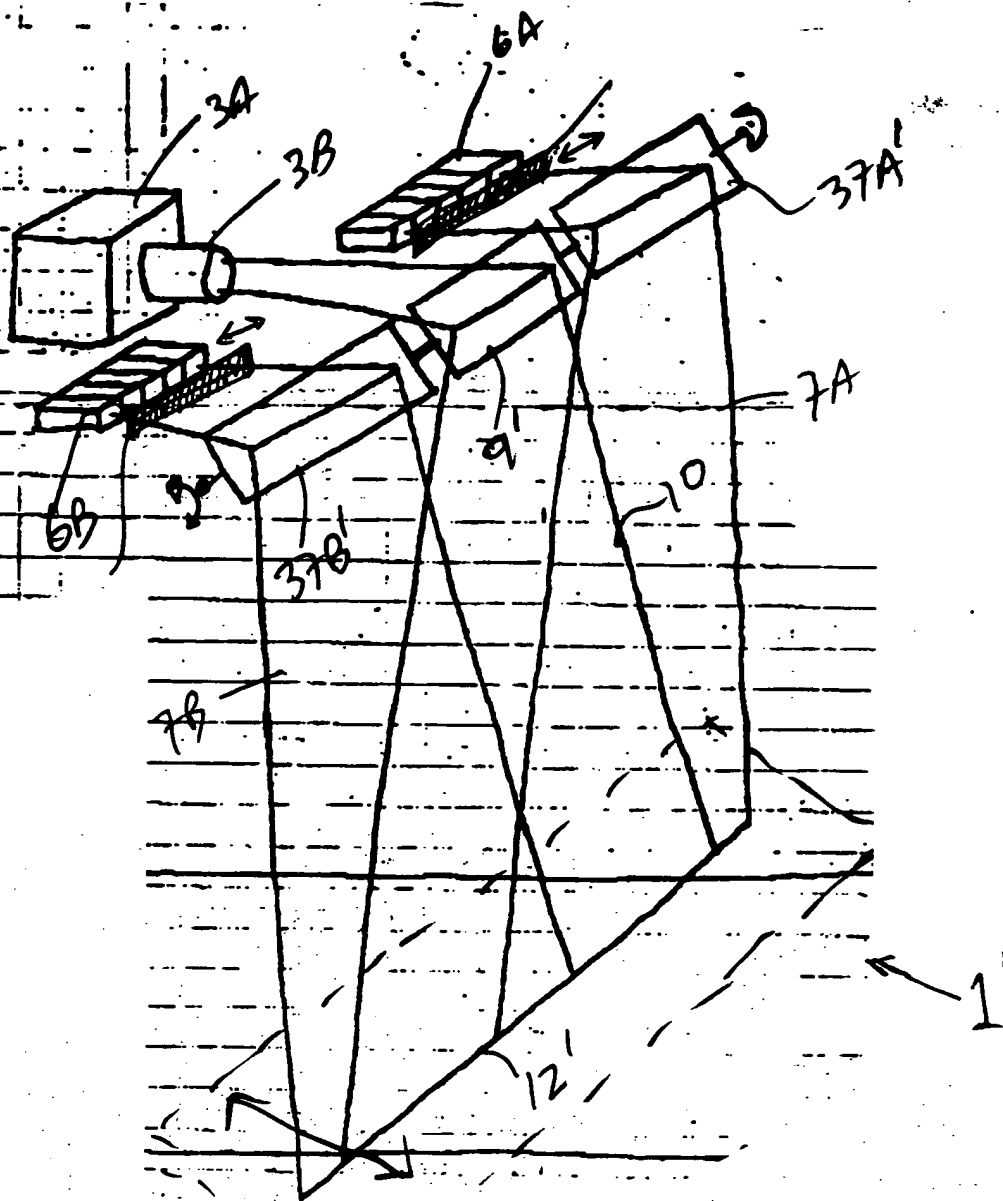
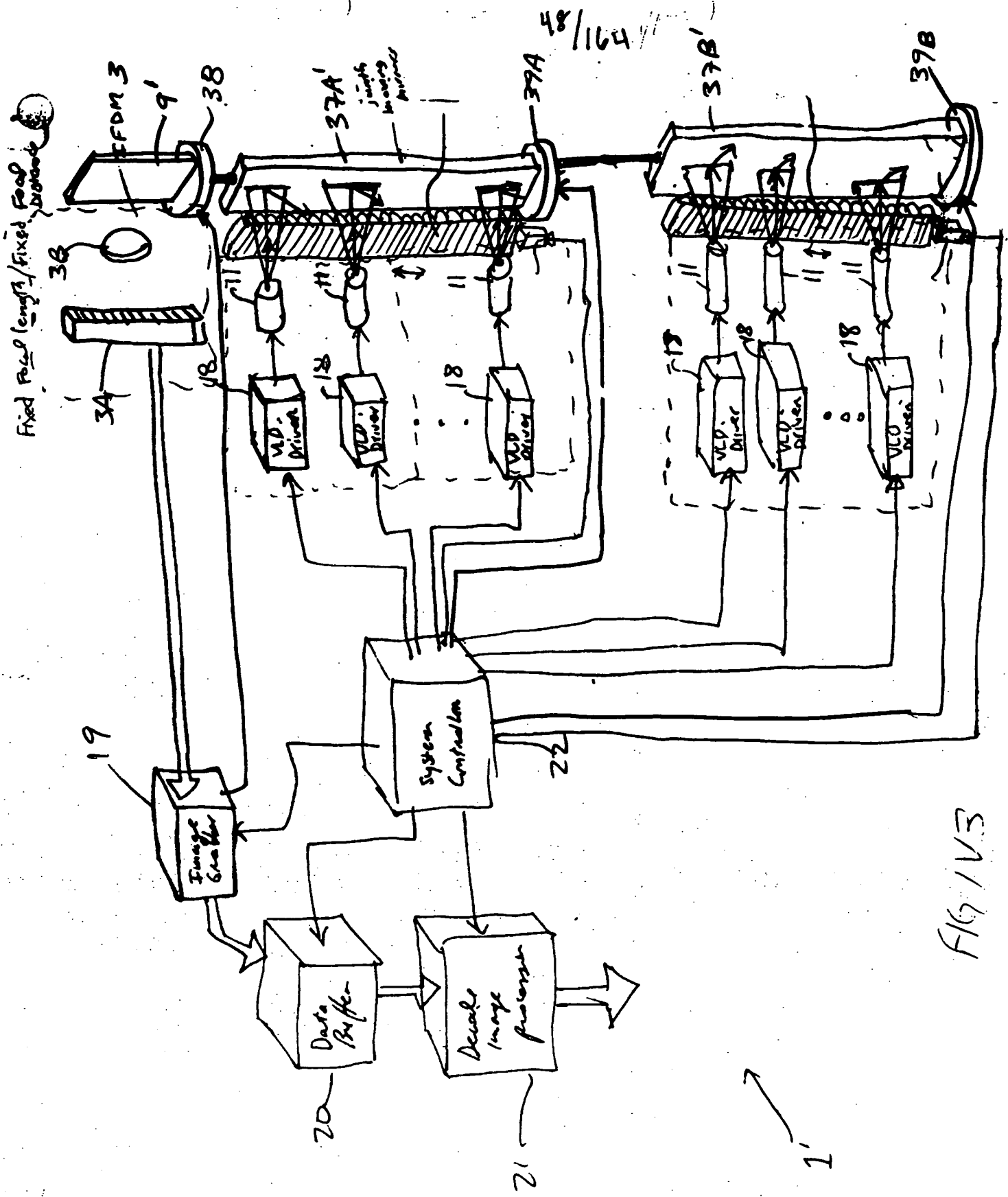
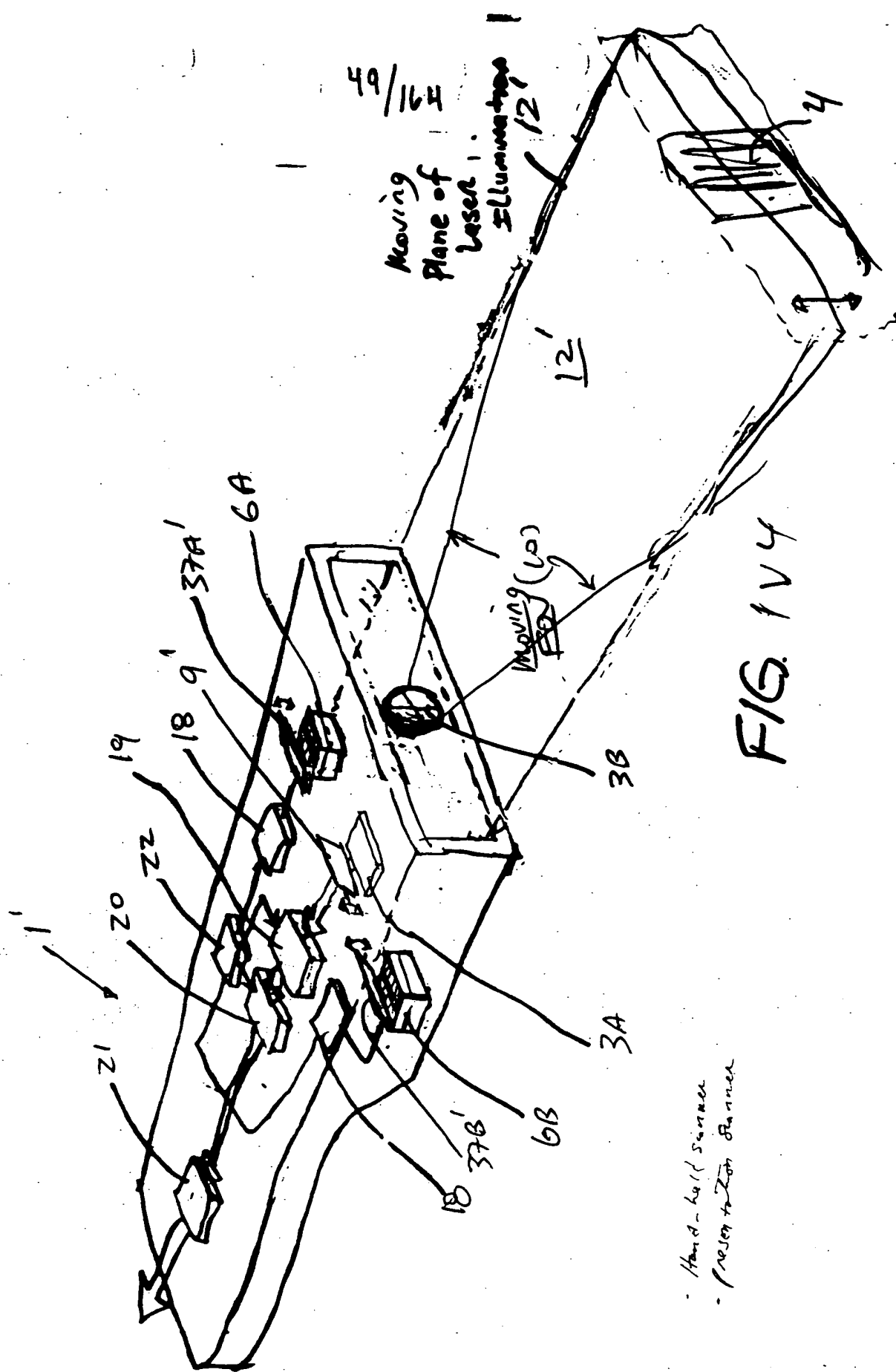


FIG. IV2

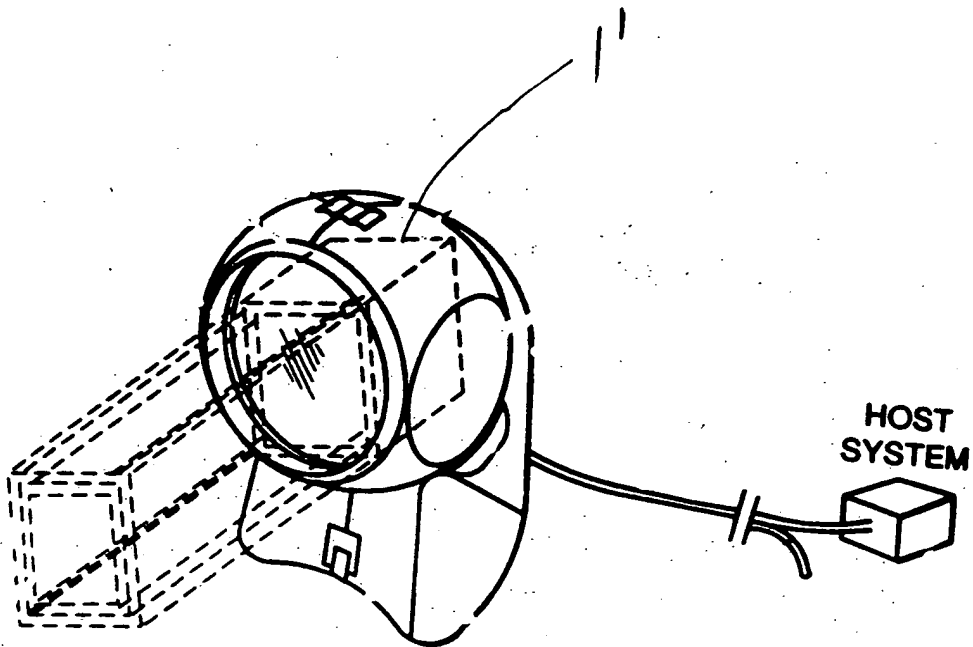
2-D
region
of
space





- Hand-held sinner
- Presentation sinner

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(Registration type scanner)

FIG. 1V5

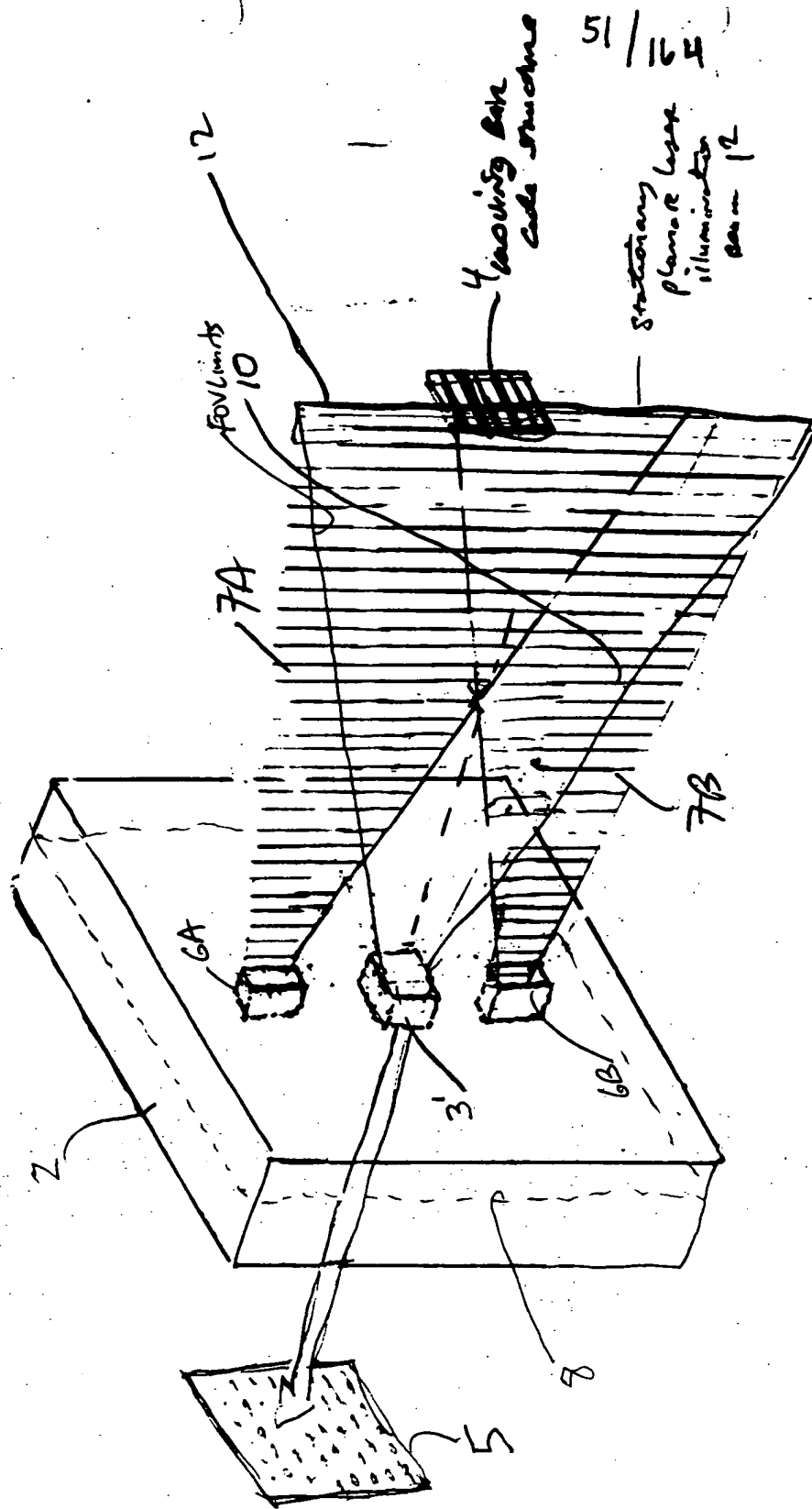


FIG. 2A

40.

FIG. 2B1

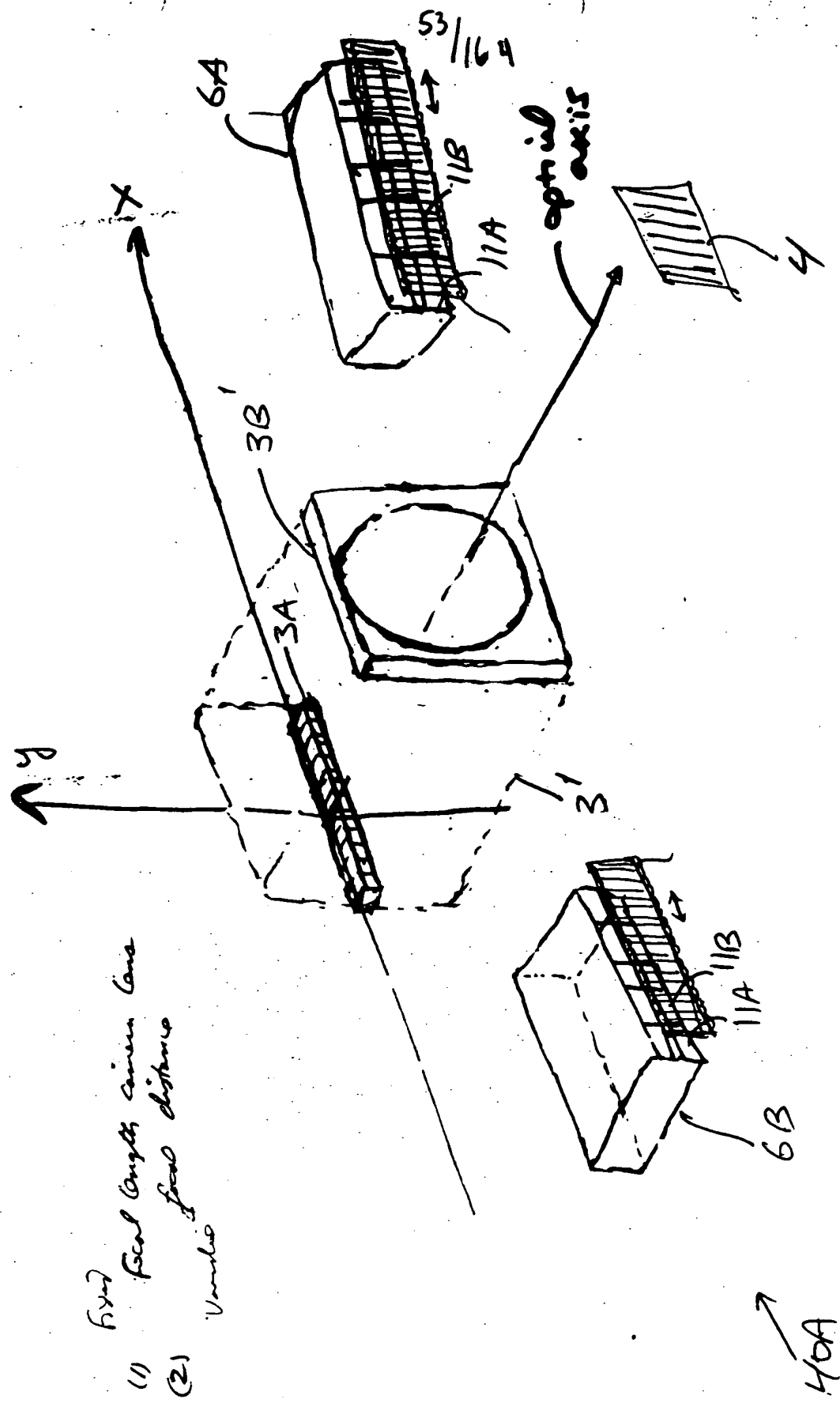


FIG. 2B2

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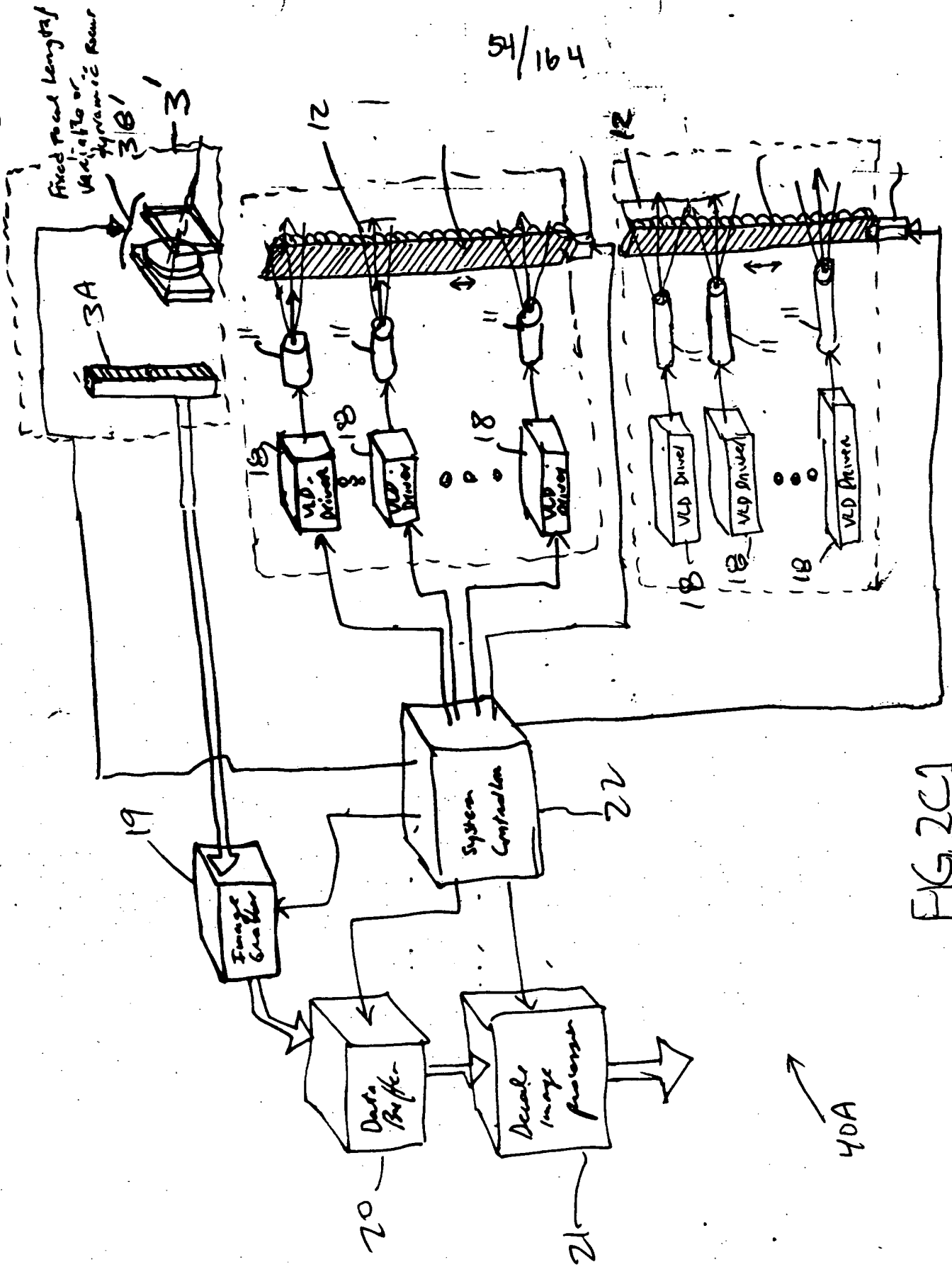


FIG. 2C1

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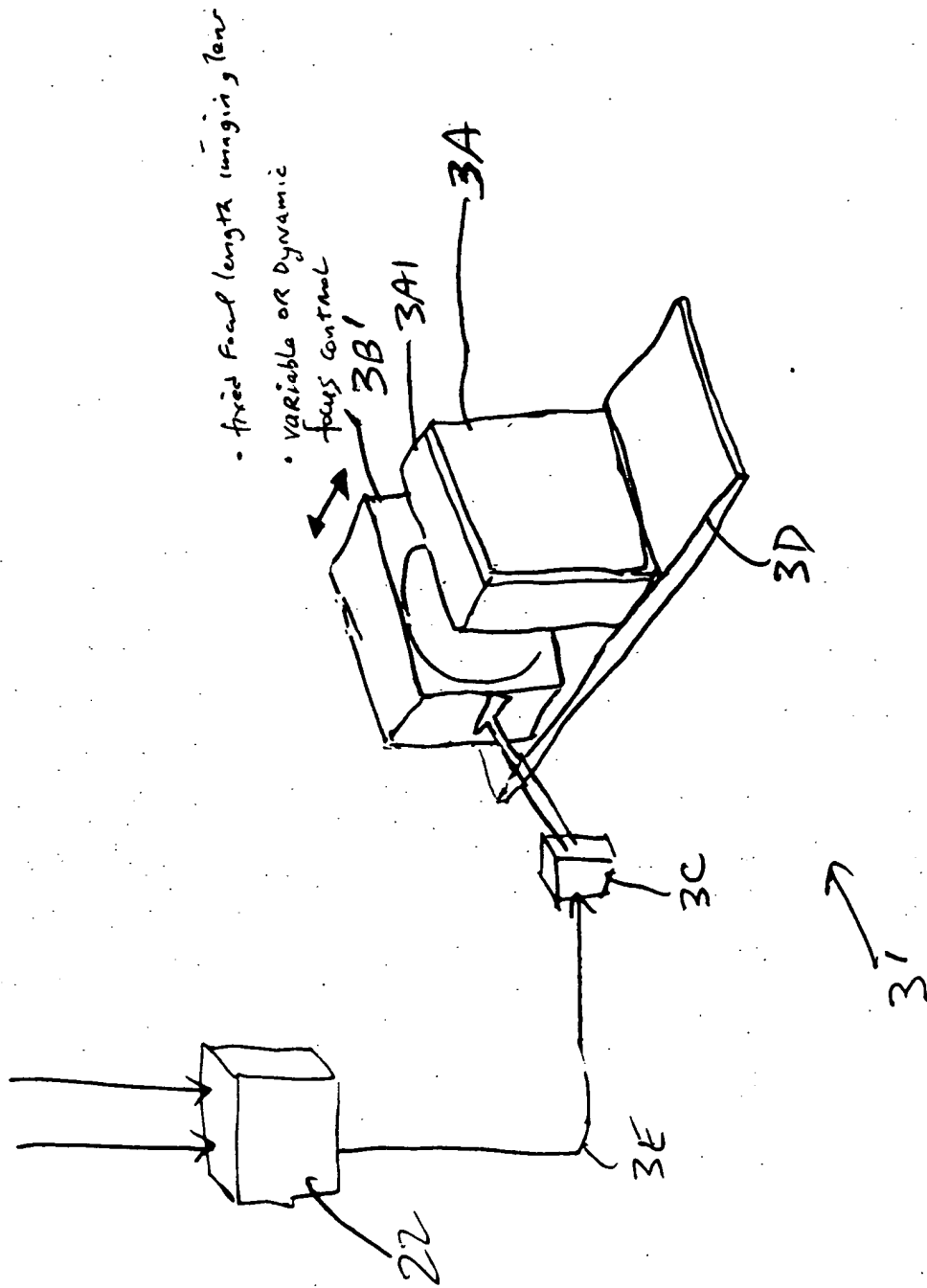
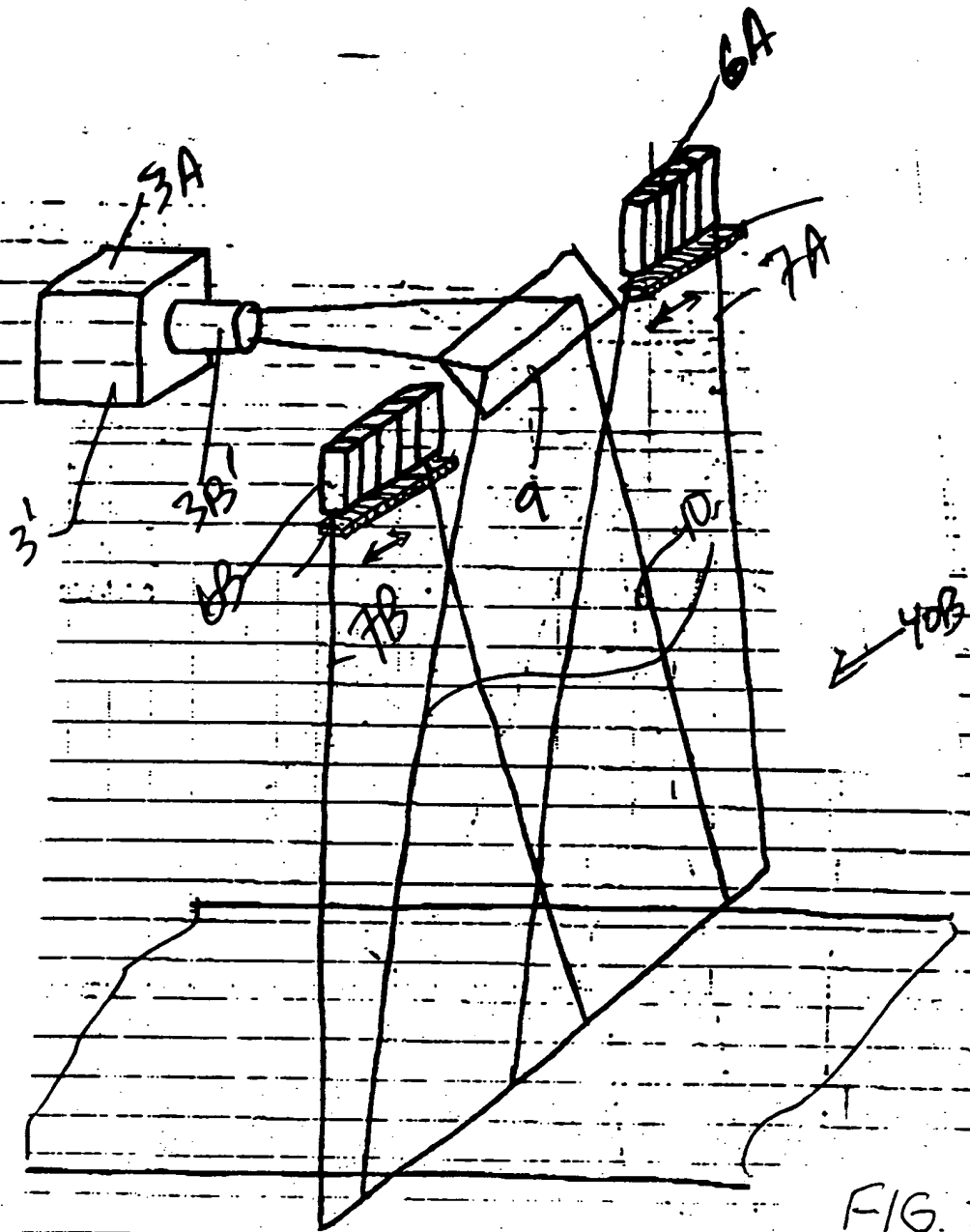
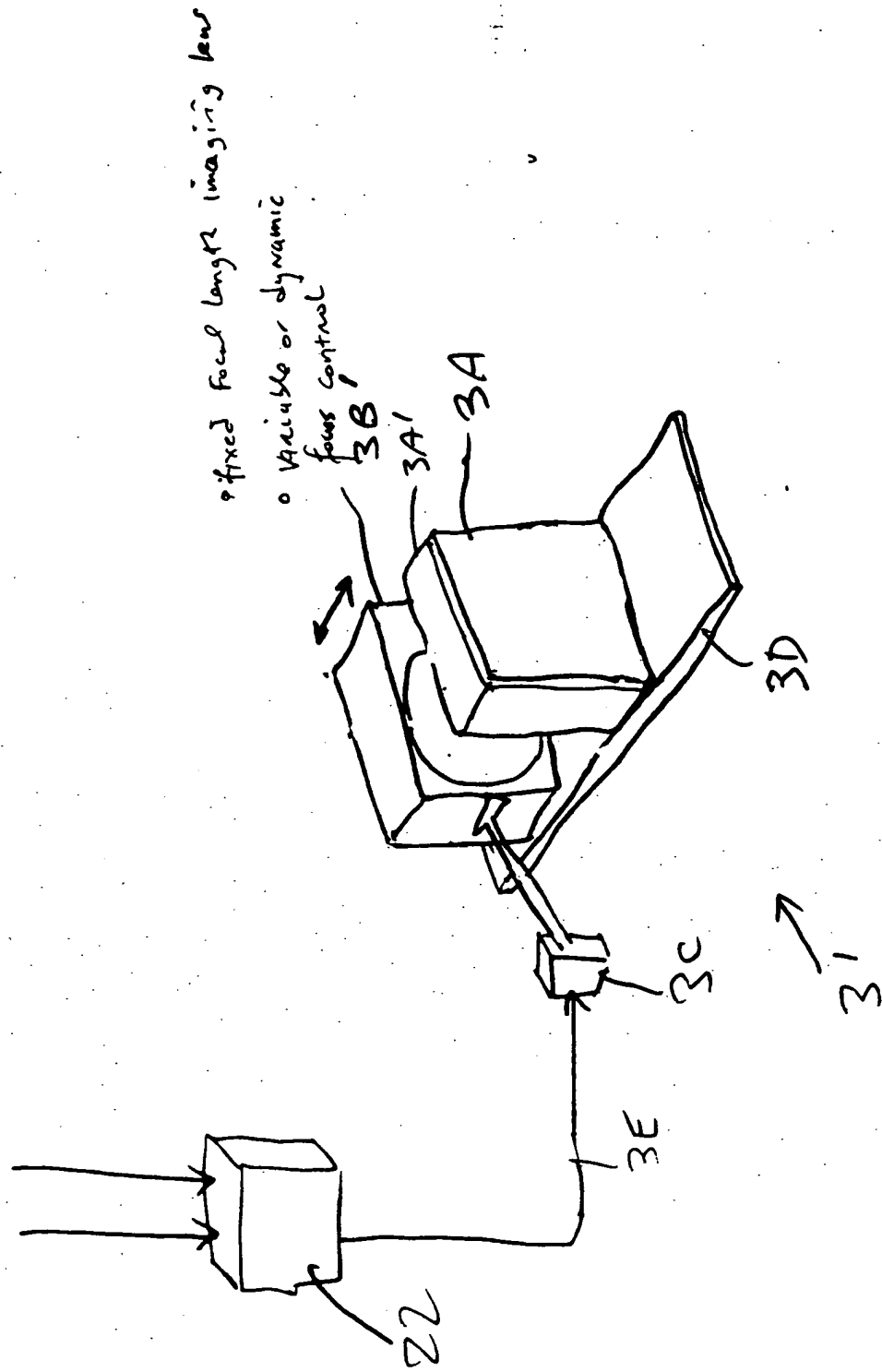


FIG. 2C2

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fixed focal length imaging lens

• variable or dynamic focus control

FIG. 2D3

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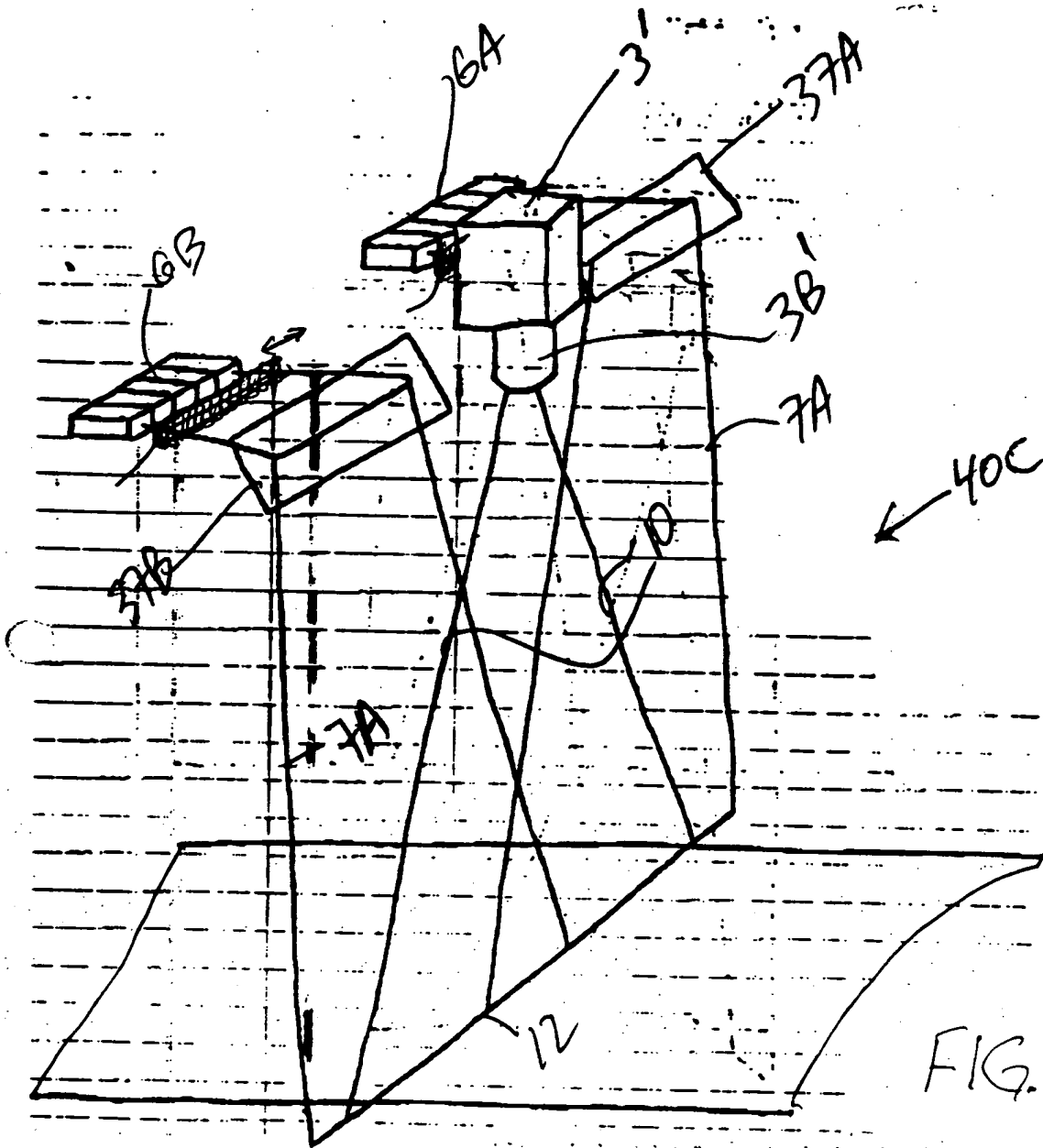
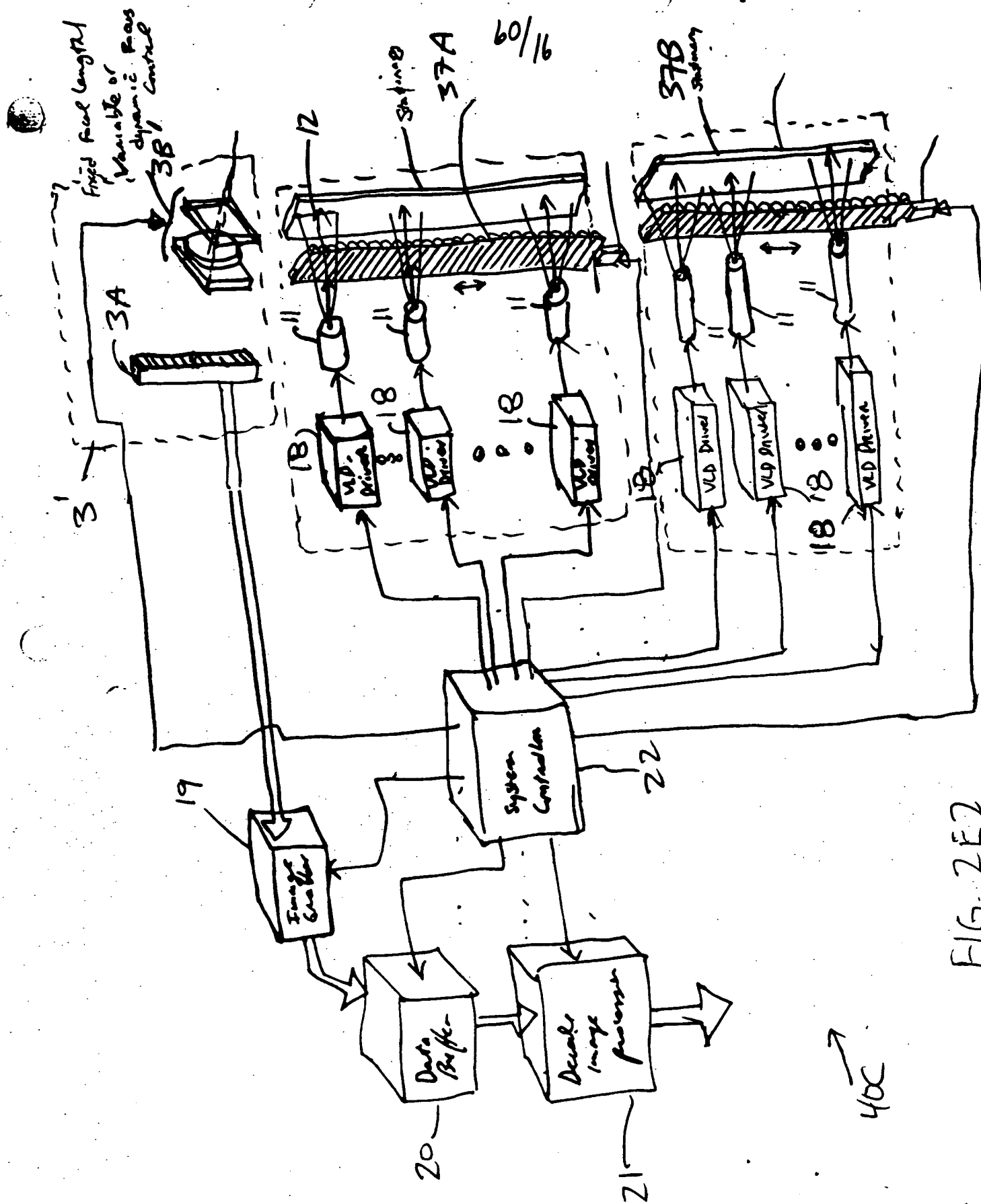


FIG. 2E1



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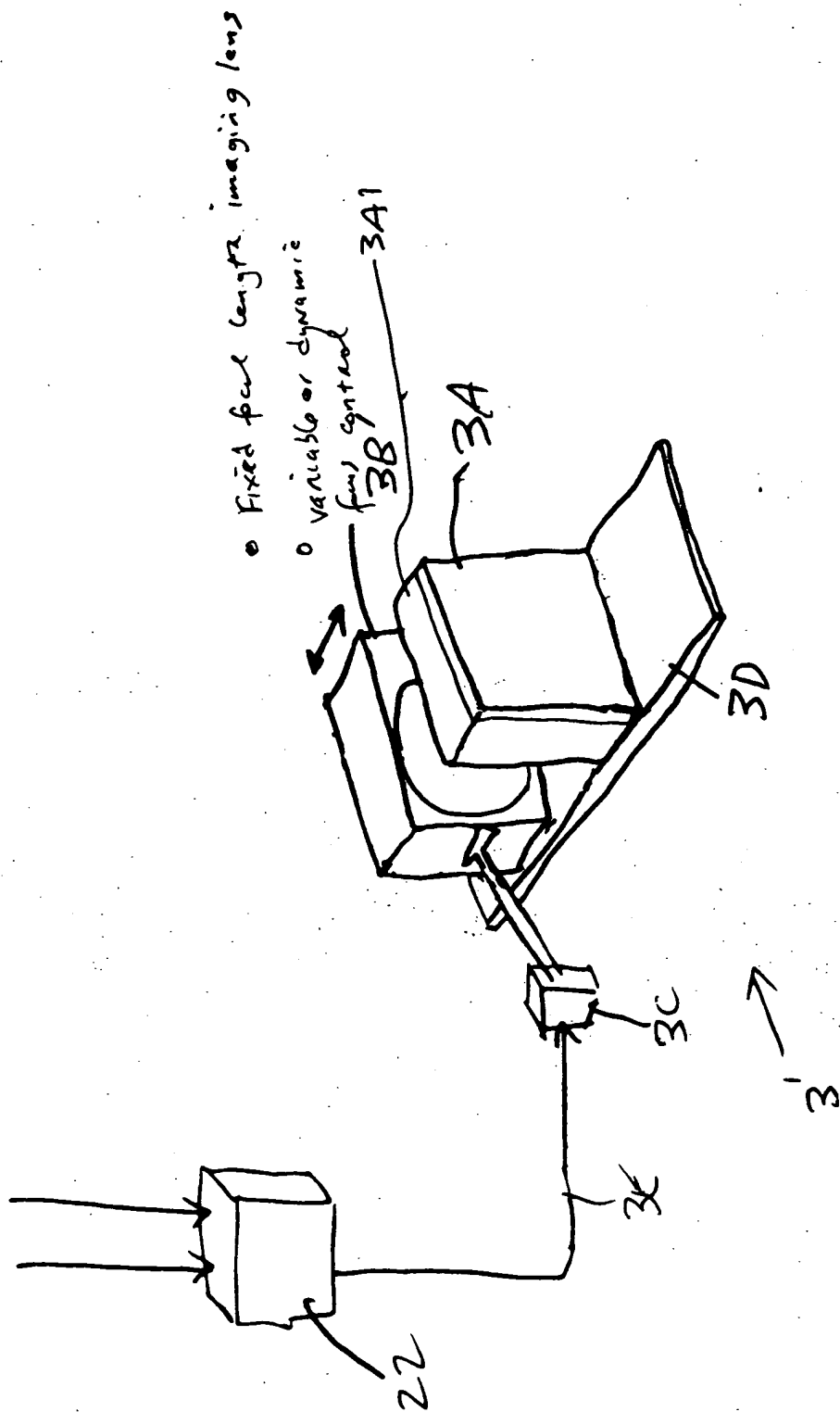


FIG. 2E3

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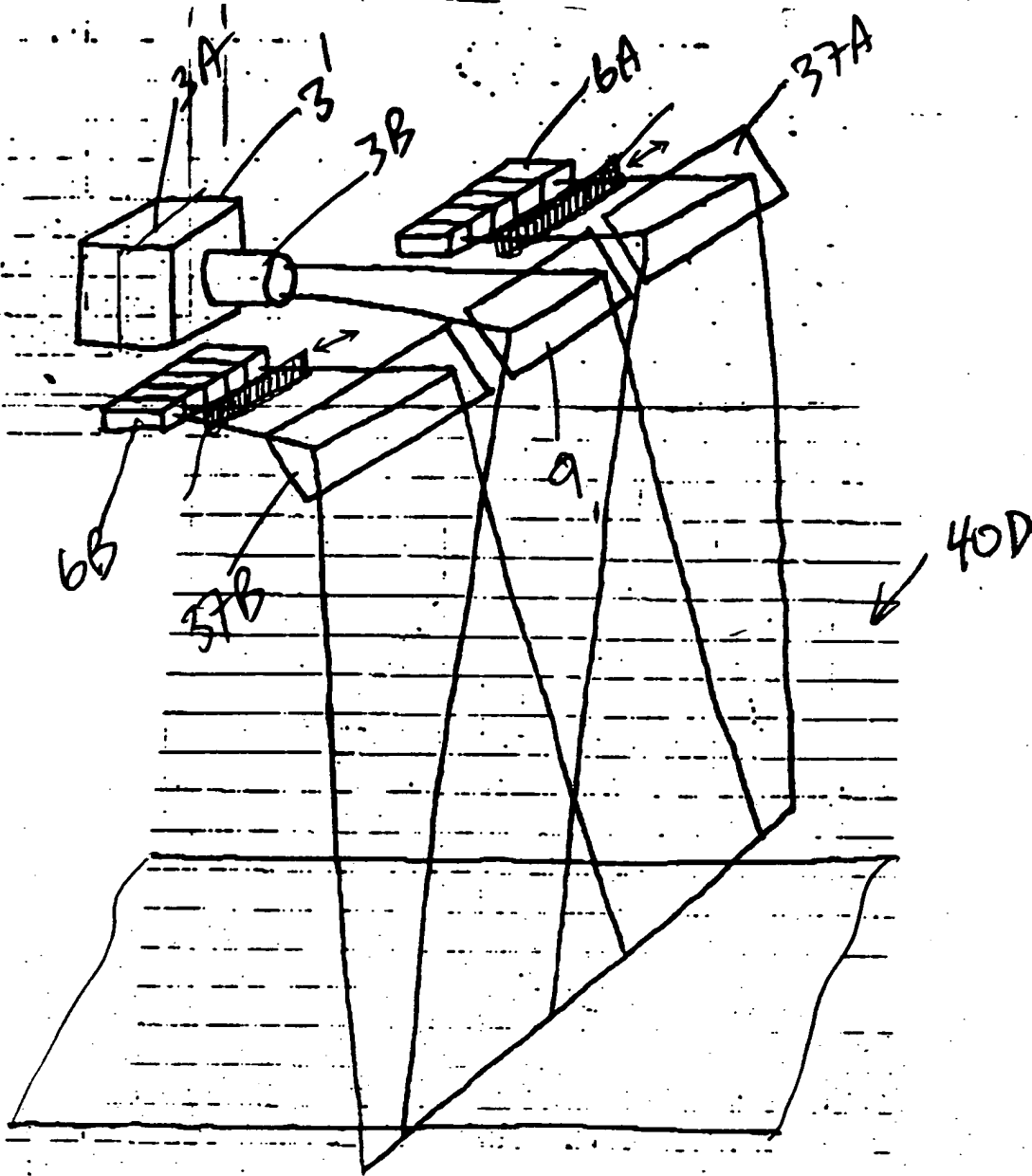


FIG 2F1

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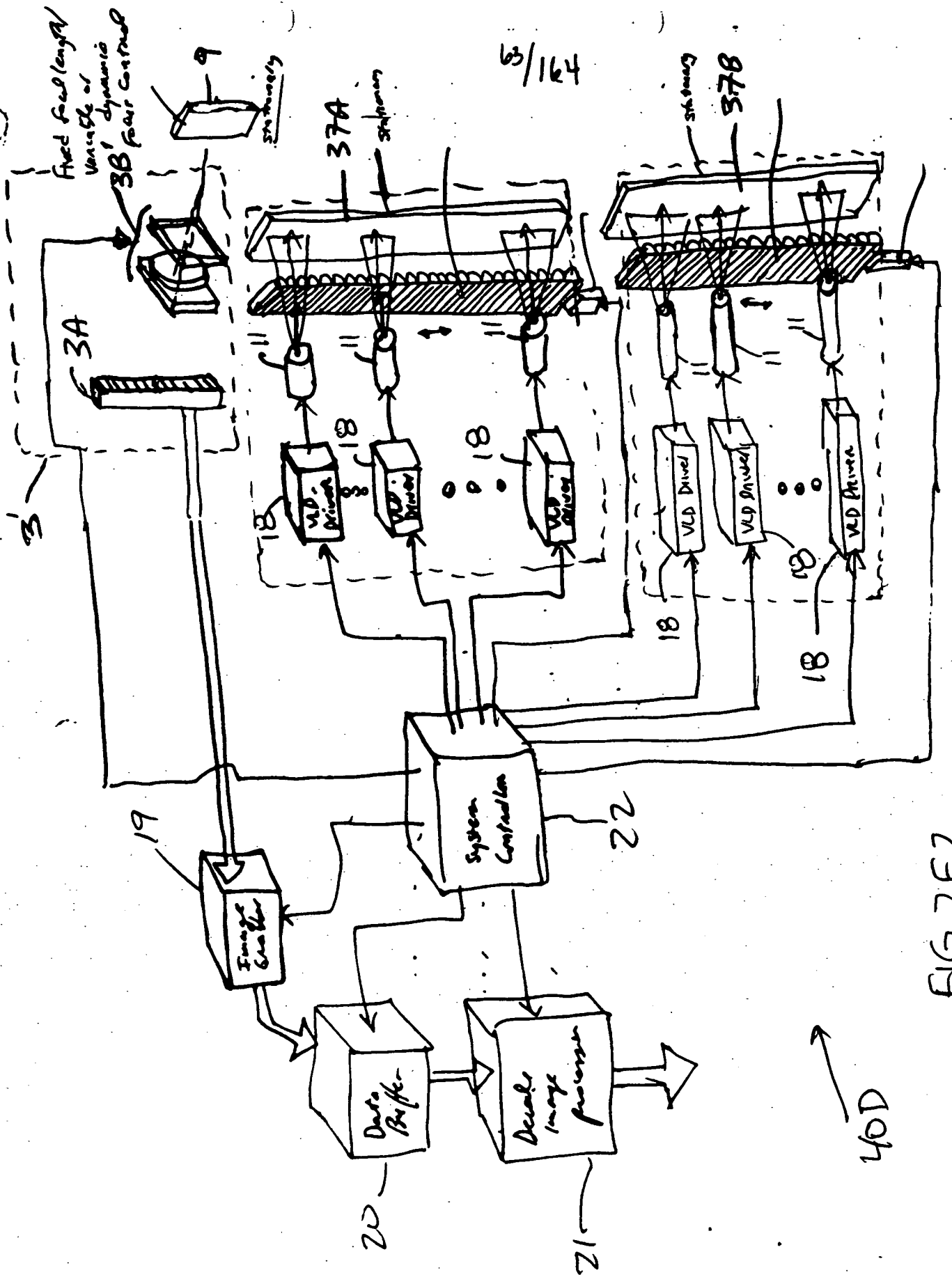


FIG. 2F2

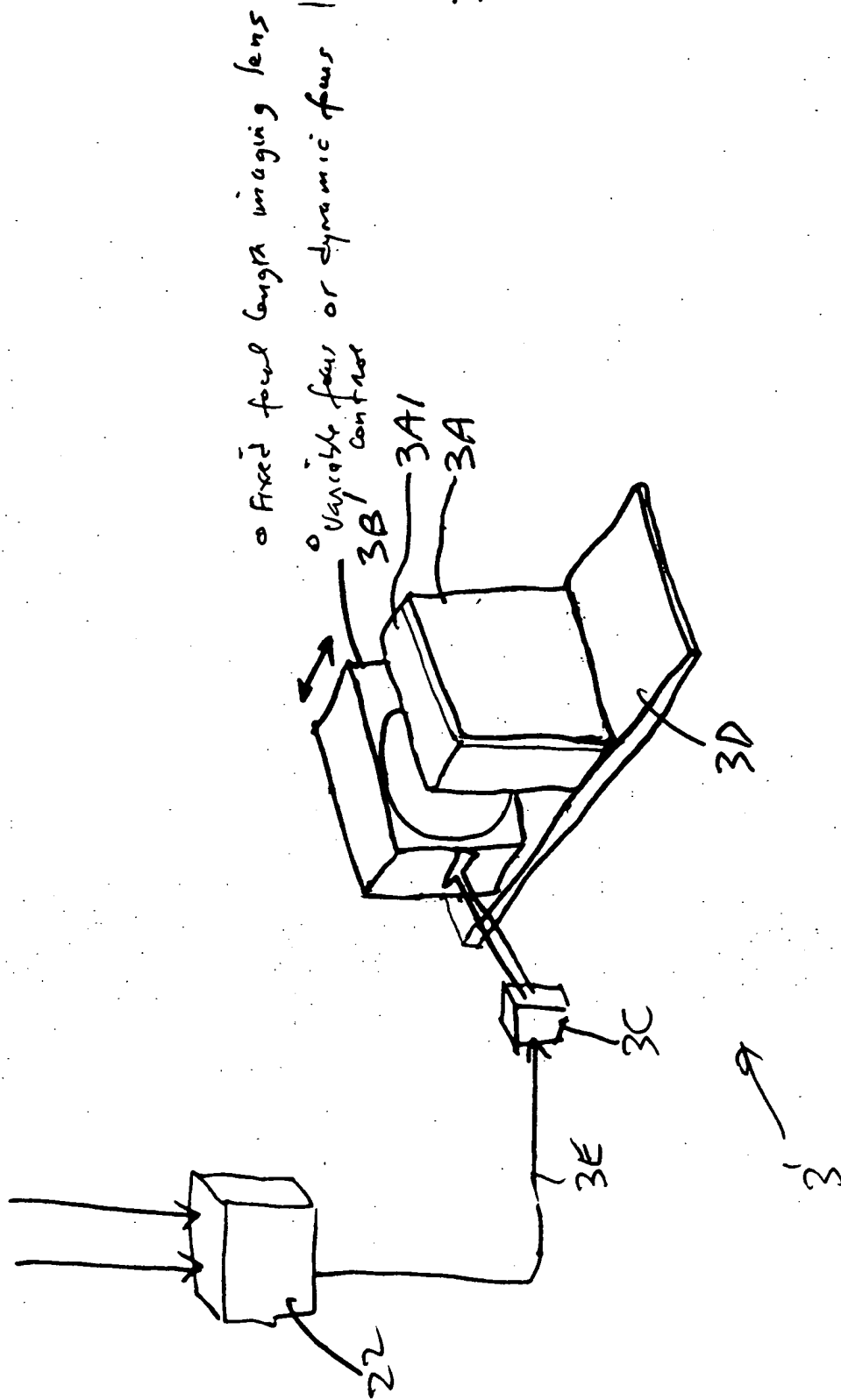


FIG. 2F3

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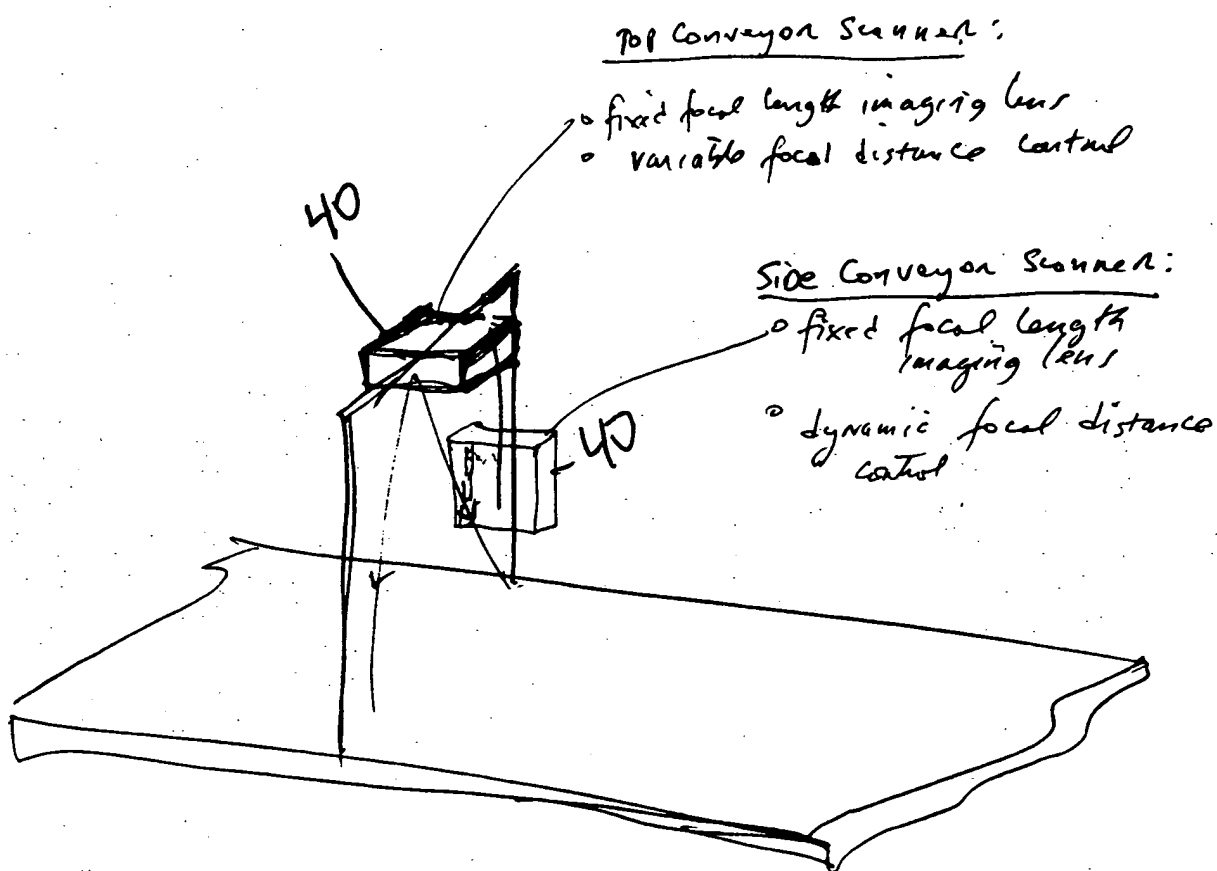


FIG. 2G

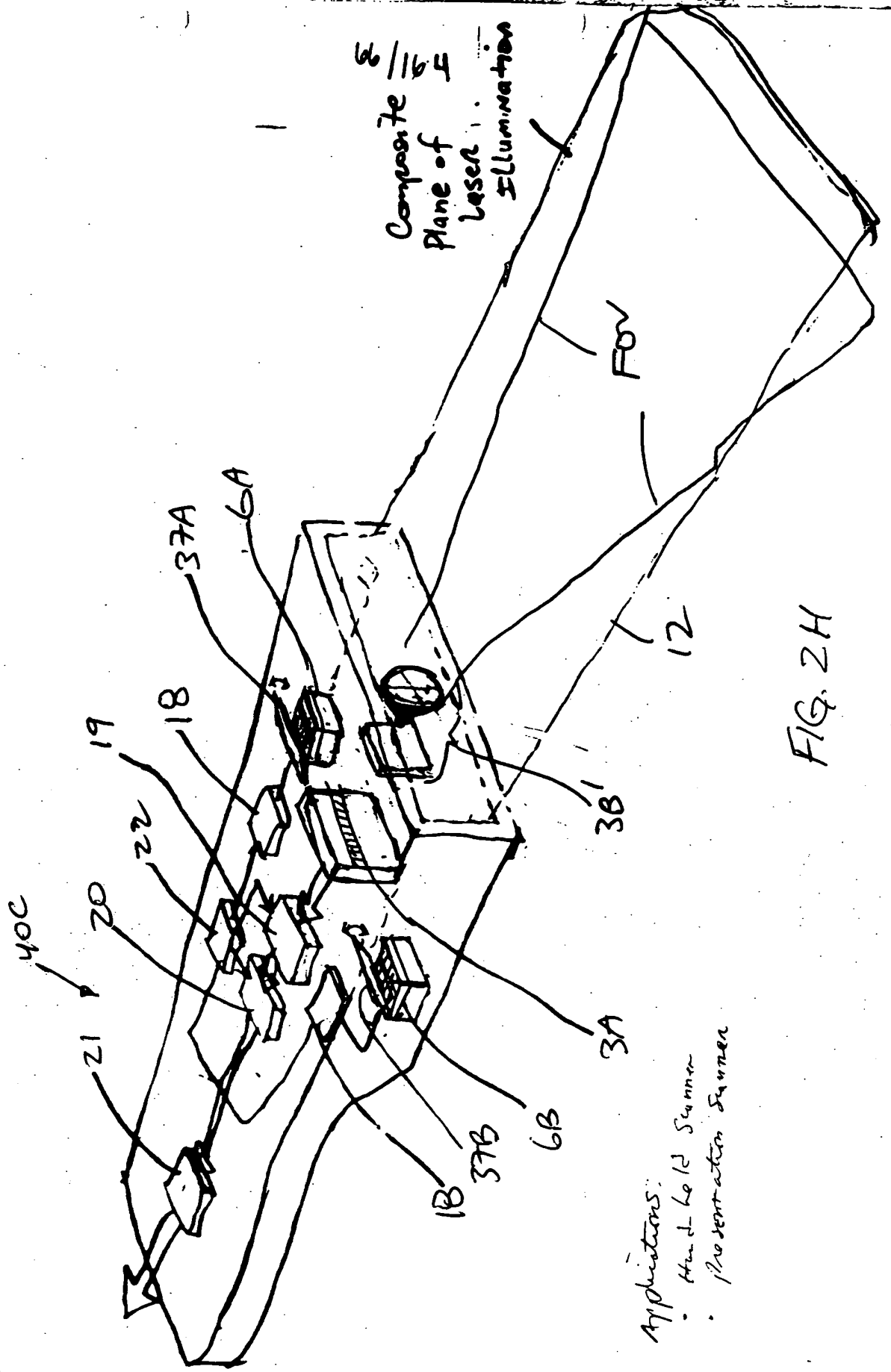


FIG. 2H

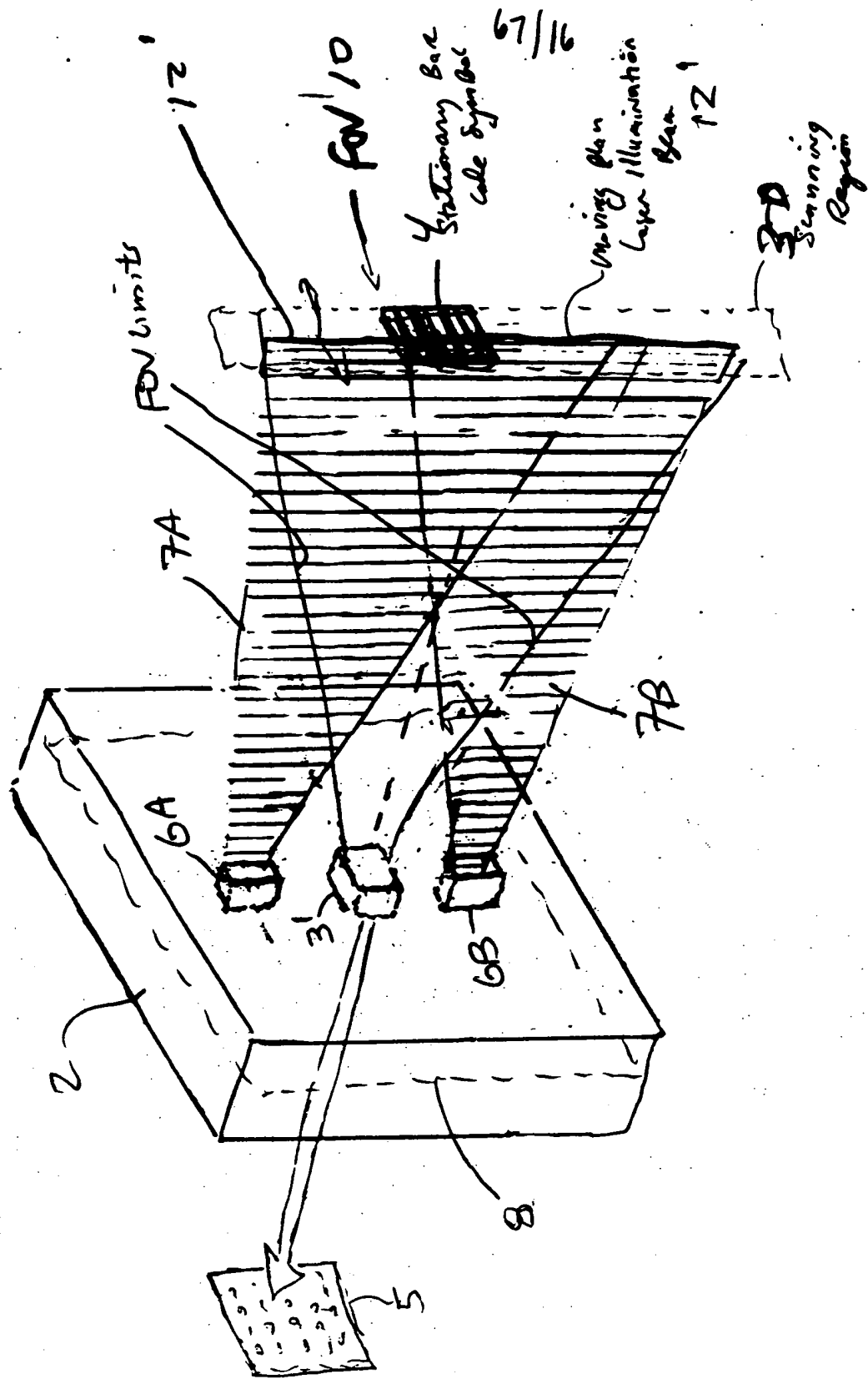
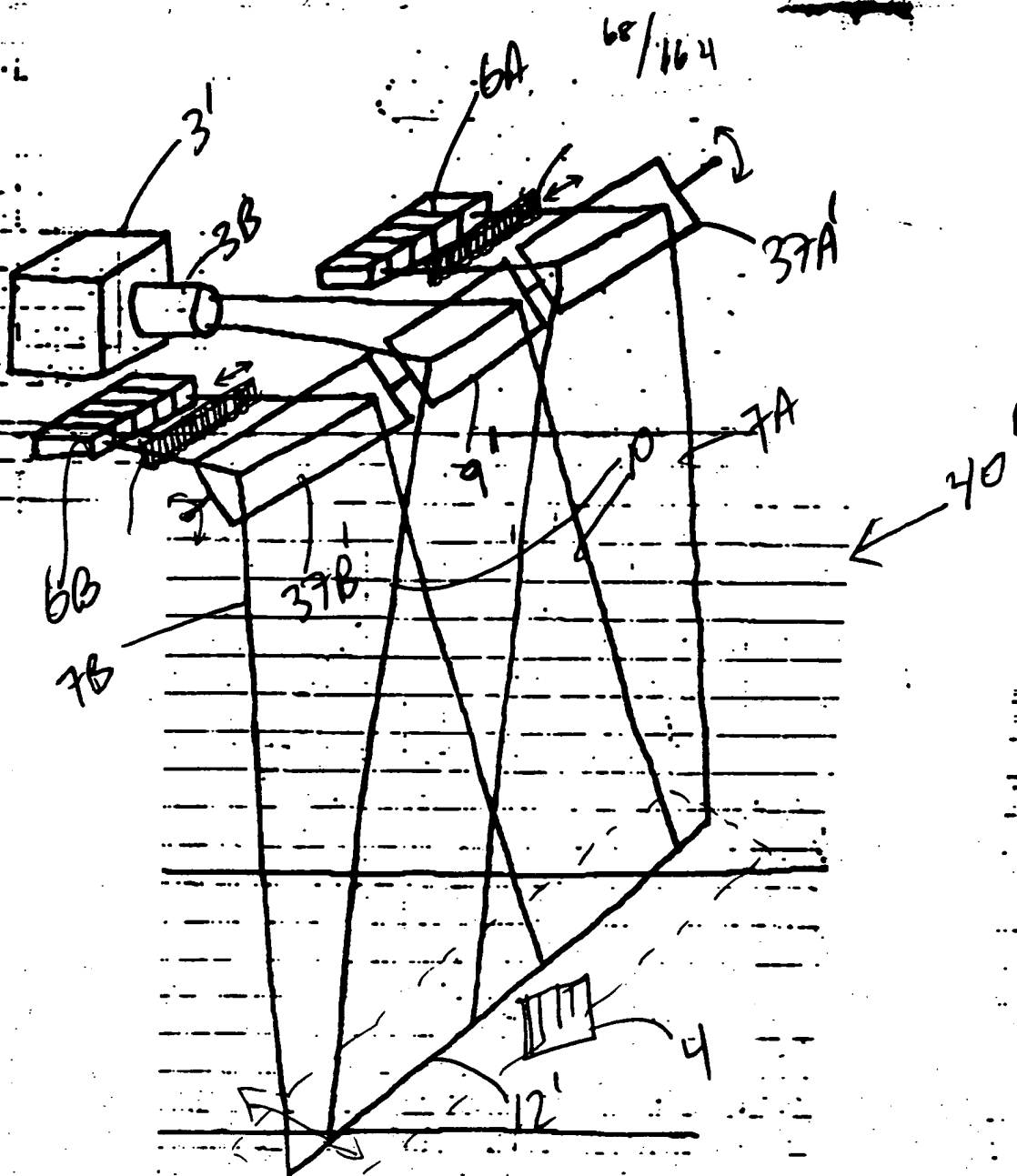


FIG. 2II



3-D
Scanning
Region

FIG 2I Z

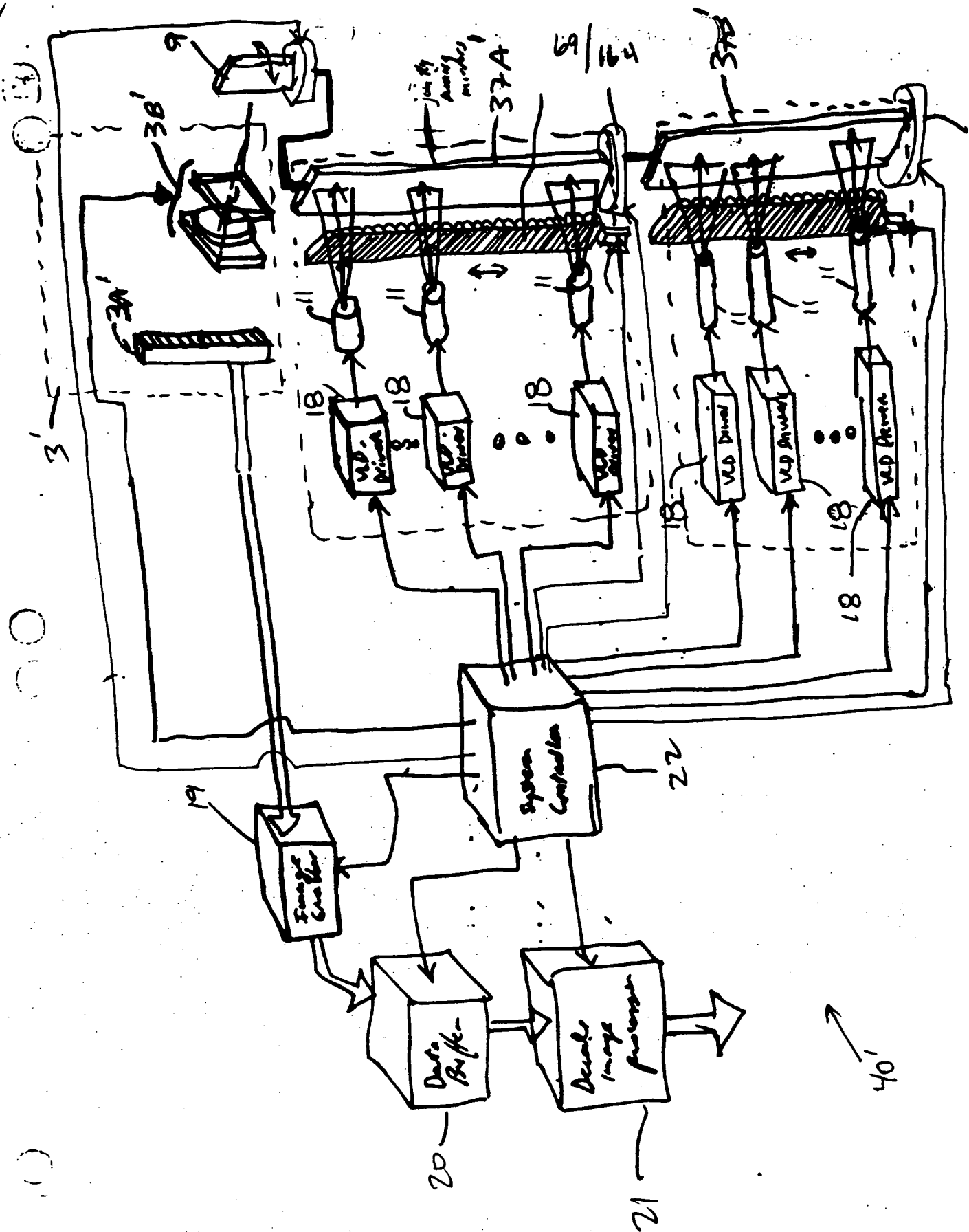
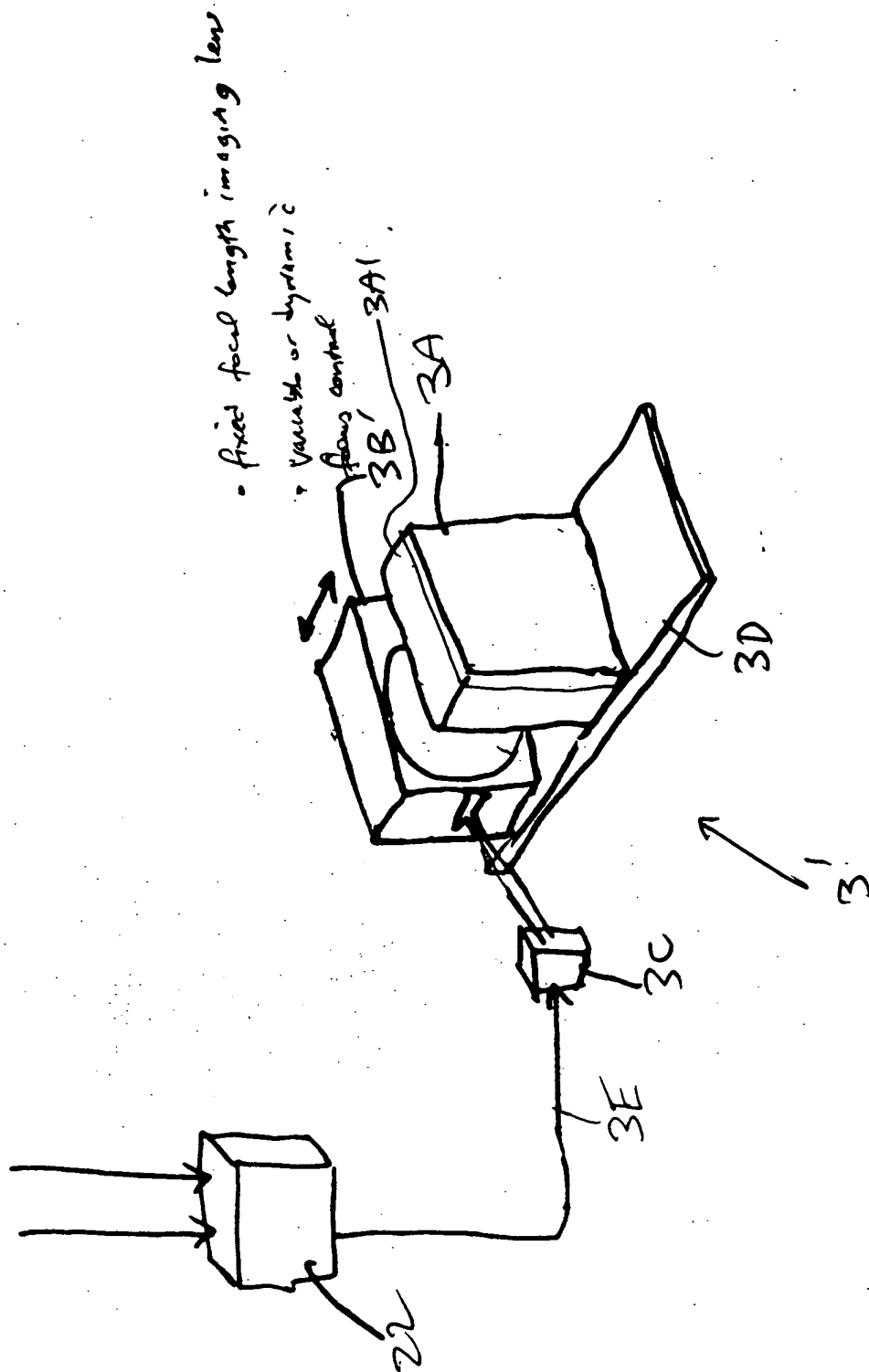


FIG. 213

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• fixed focal length imaging lens

• Variable or dynamic

focus control

FIG. 2I4

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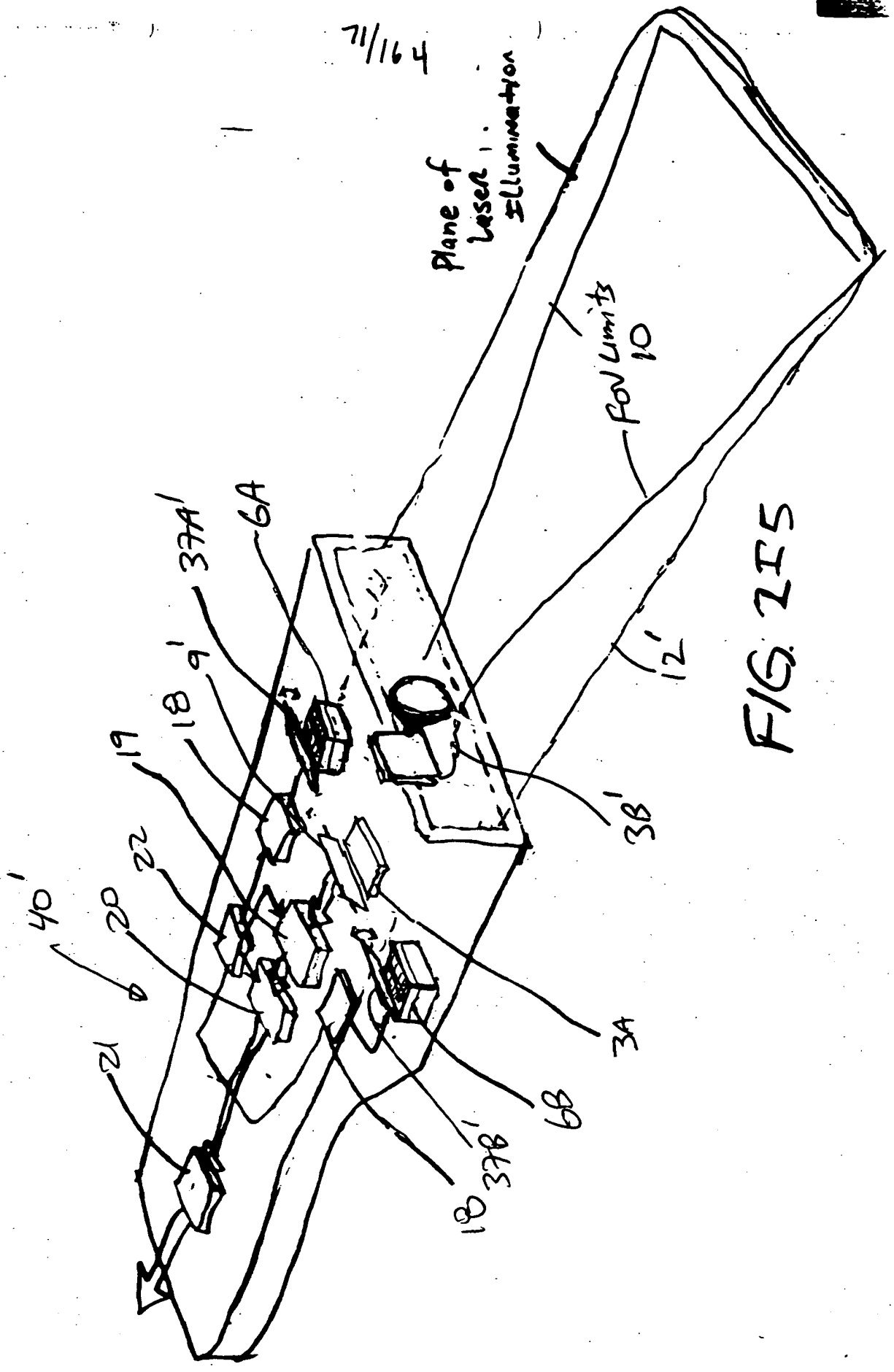


FIG. 215

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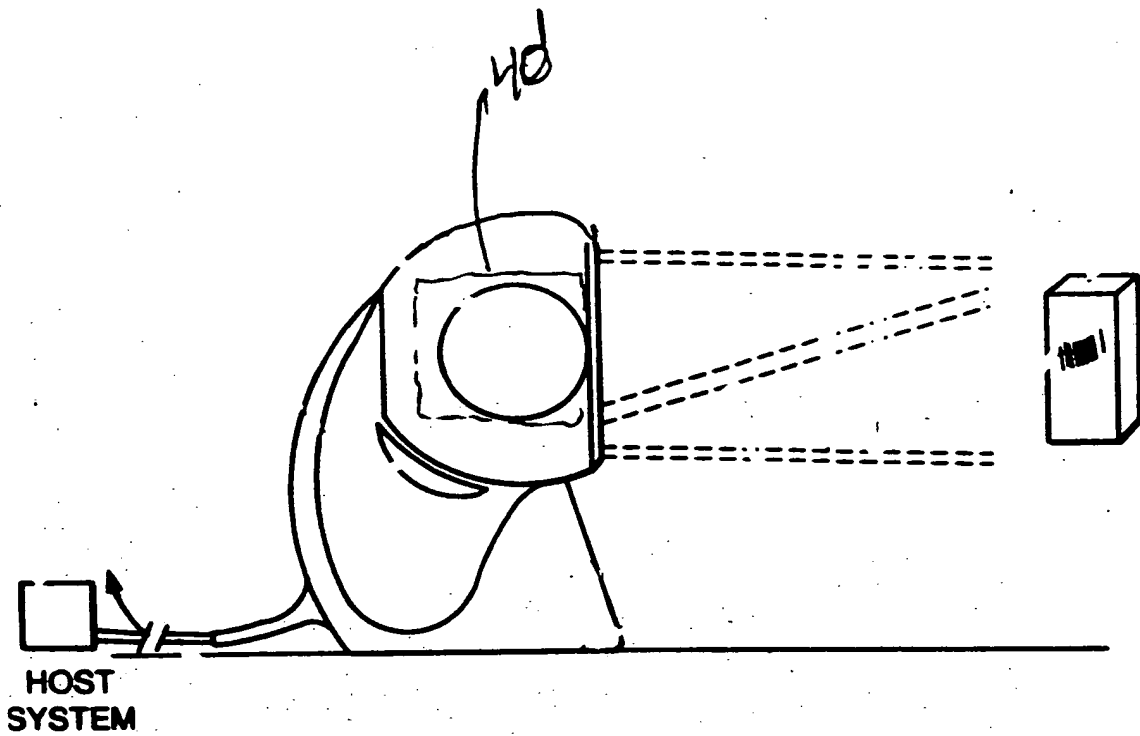


FIG. 2I6

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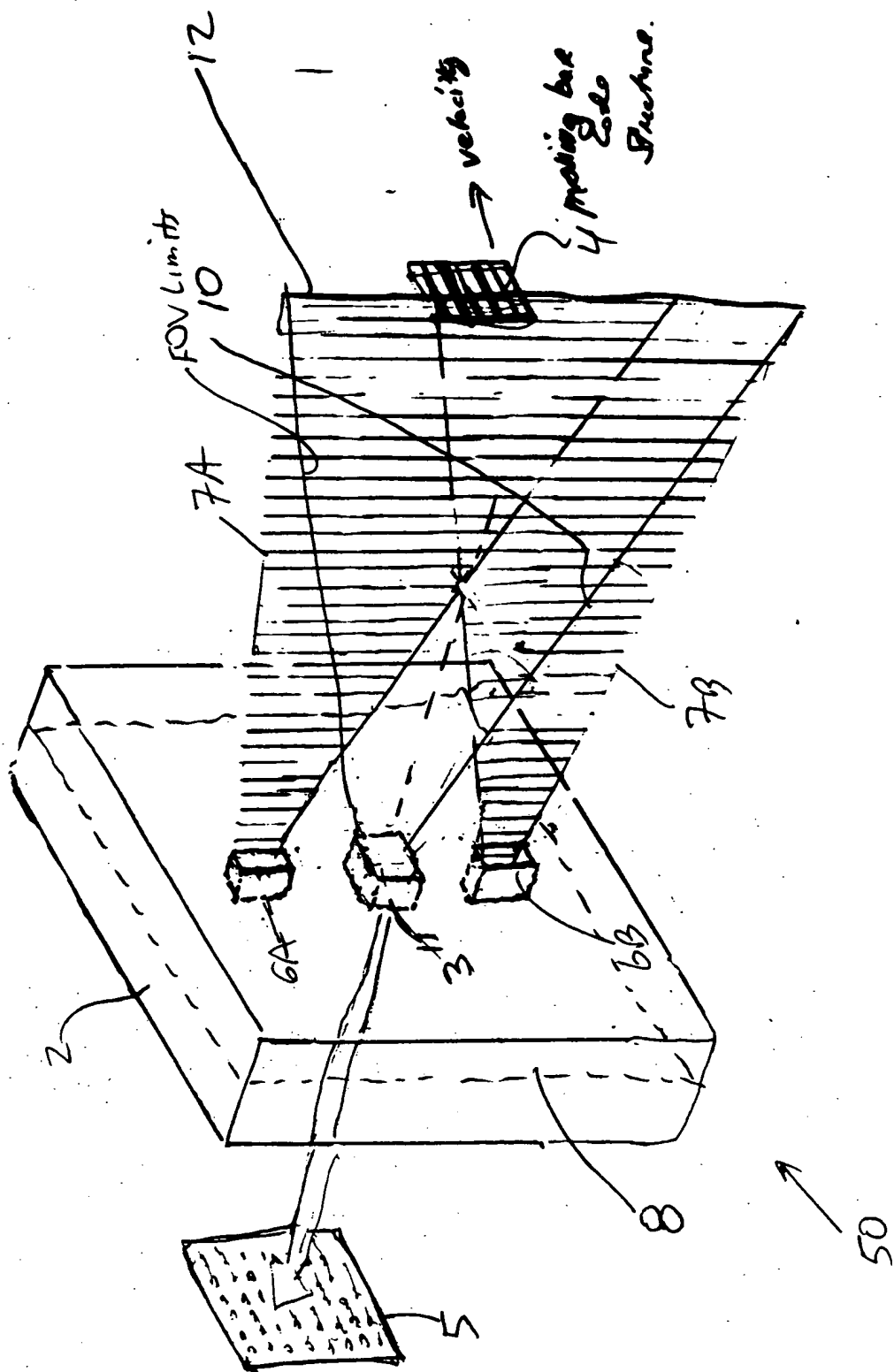


FIG 3A

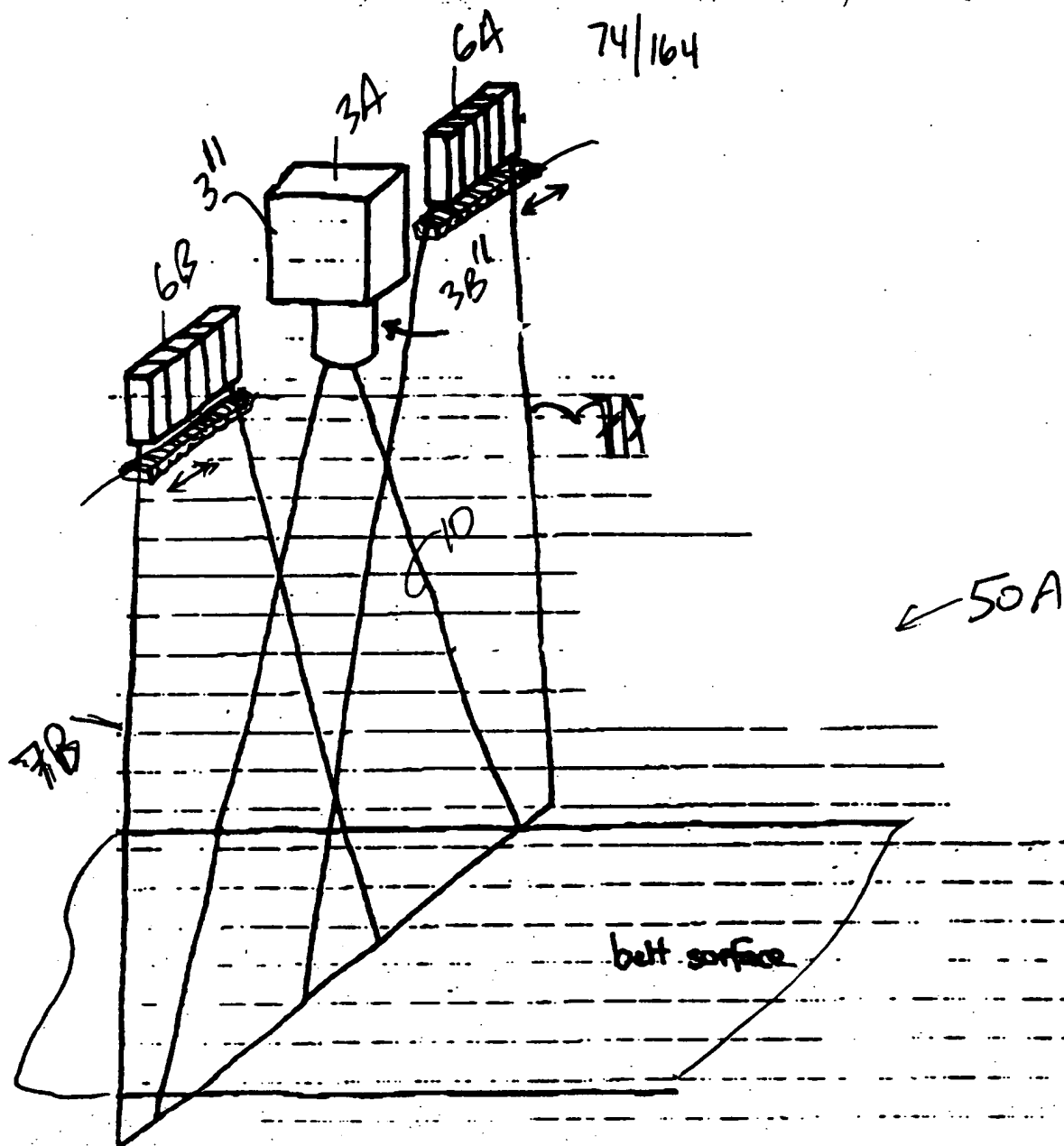
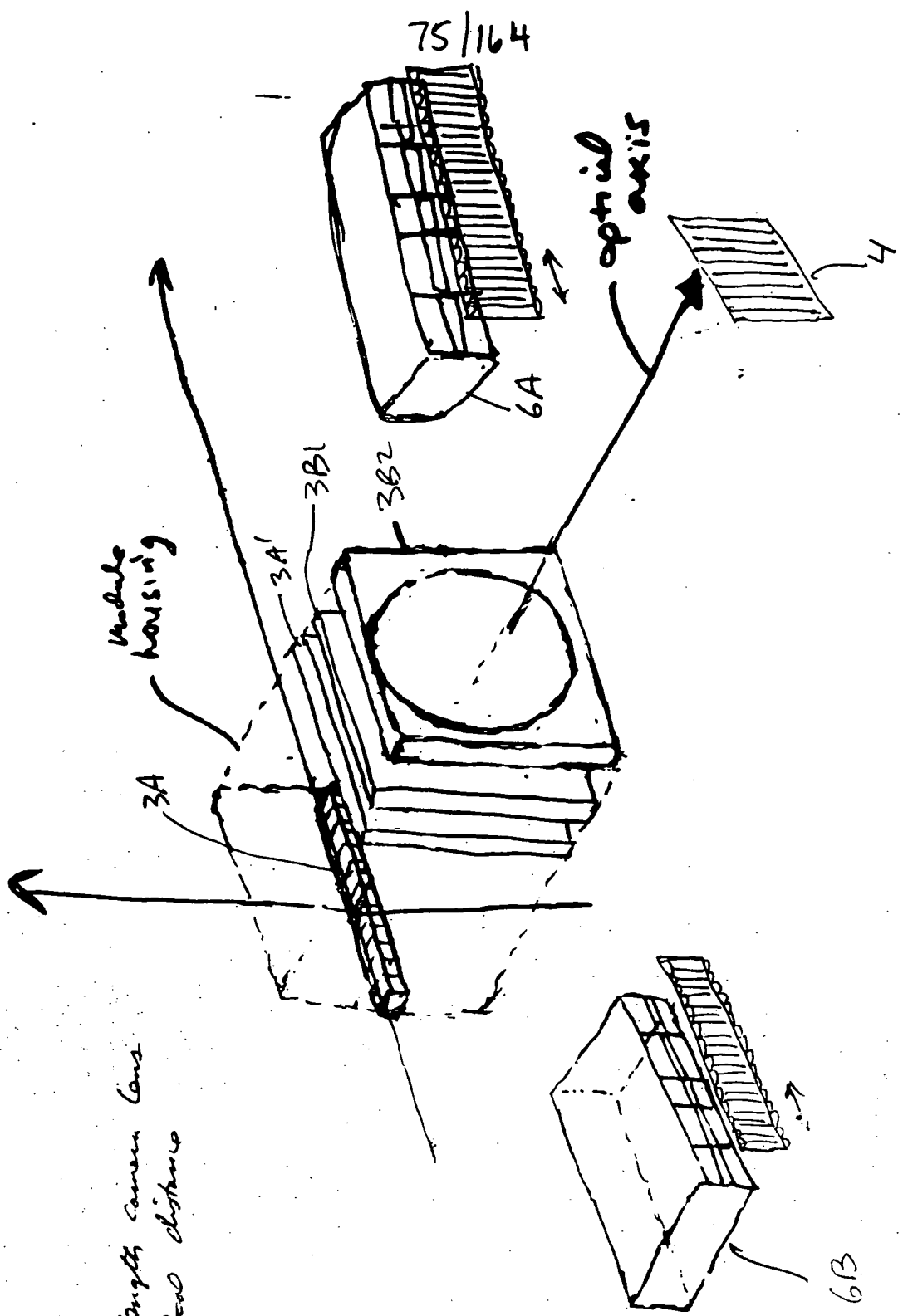


FIG. 3B1



(1) Variable focal length camera lens
 (2) Variable focus distance

FIG 3B2

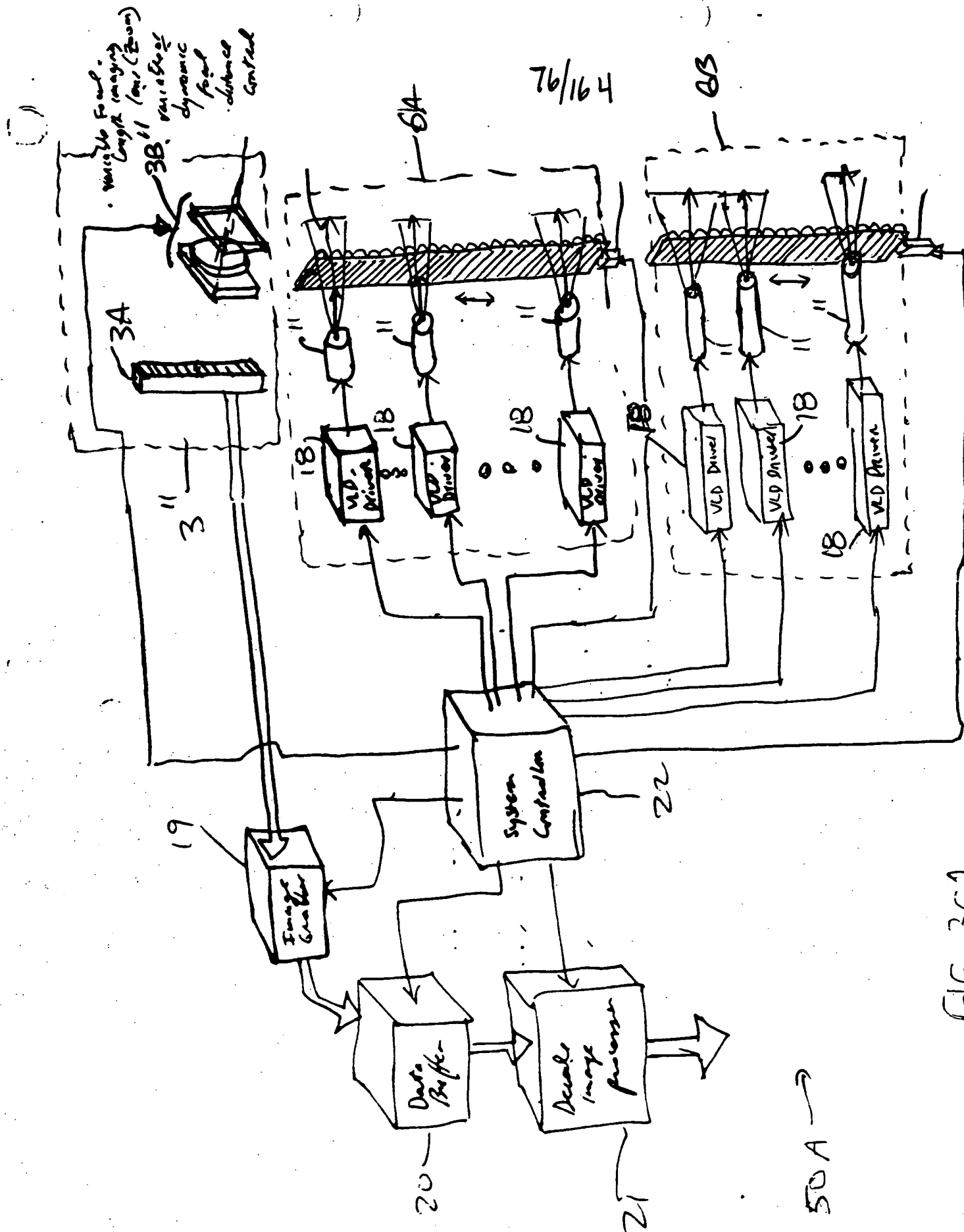
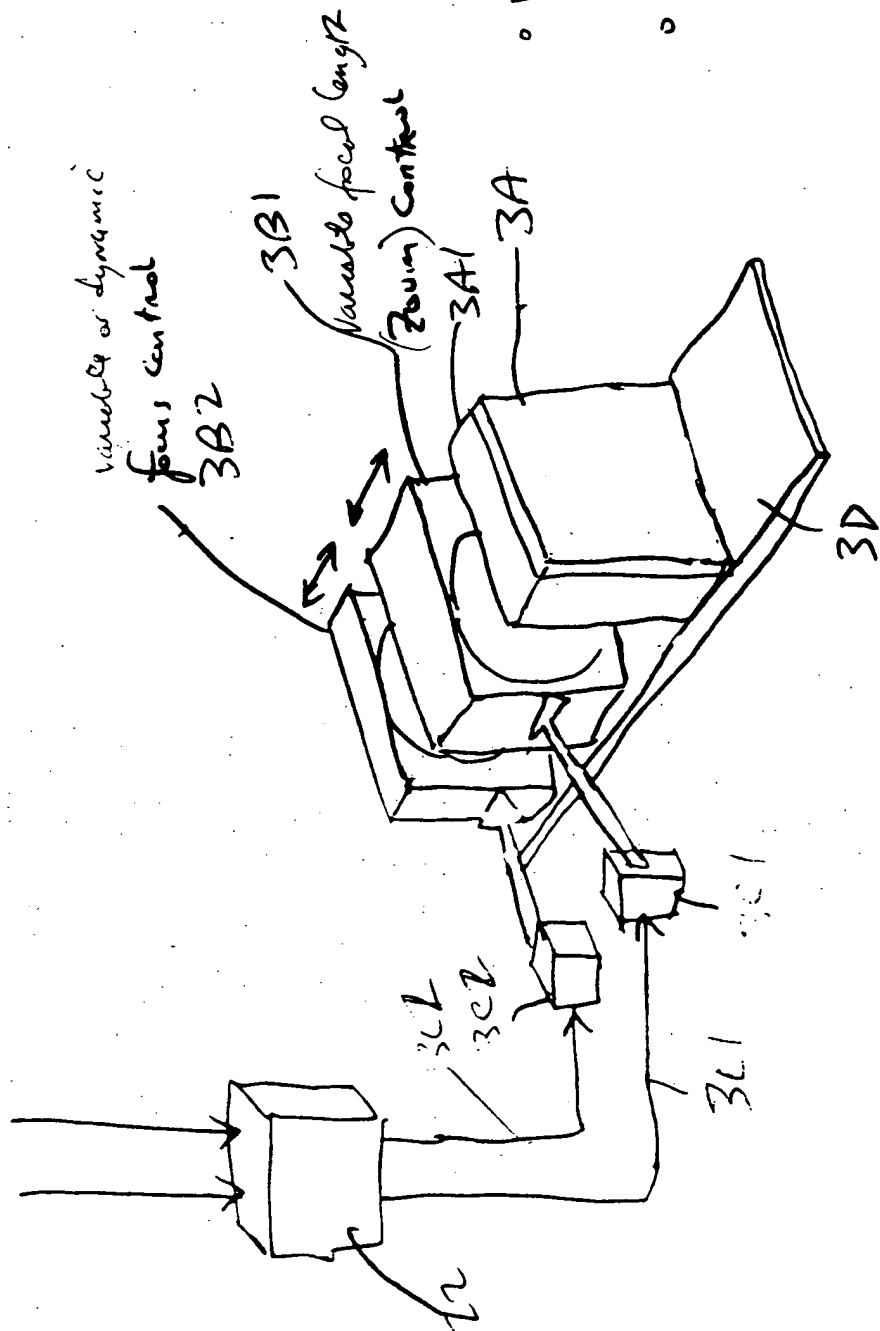


FIG 3C1



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◦ Variable focal length lenses lens

◦ Variable focal distance

FIG. 3C2

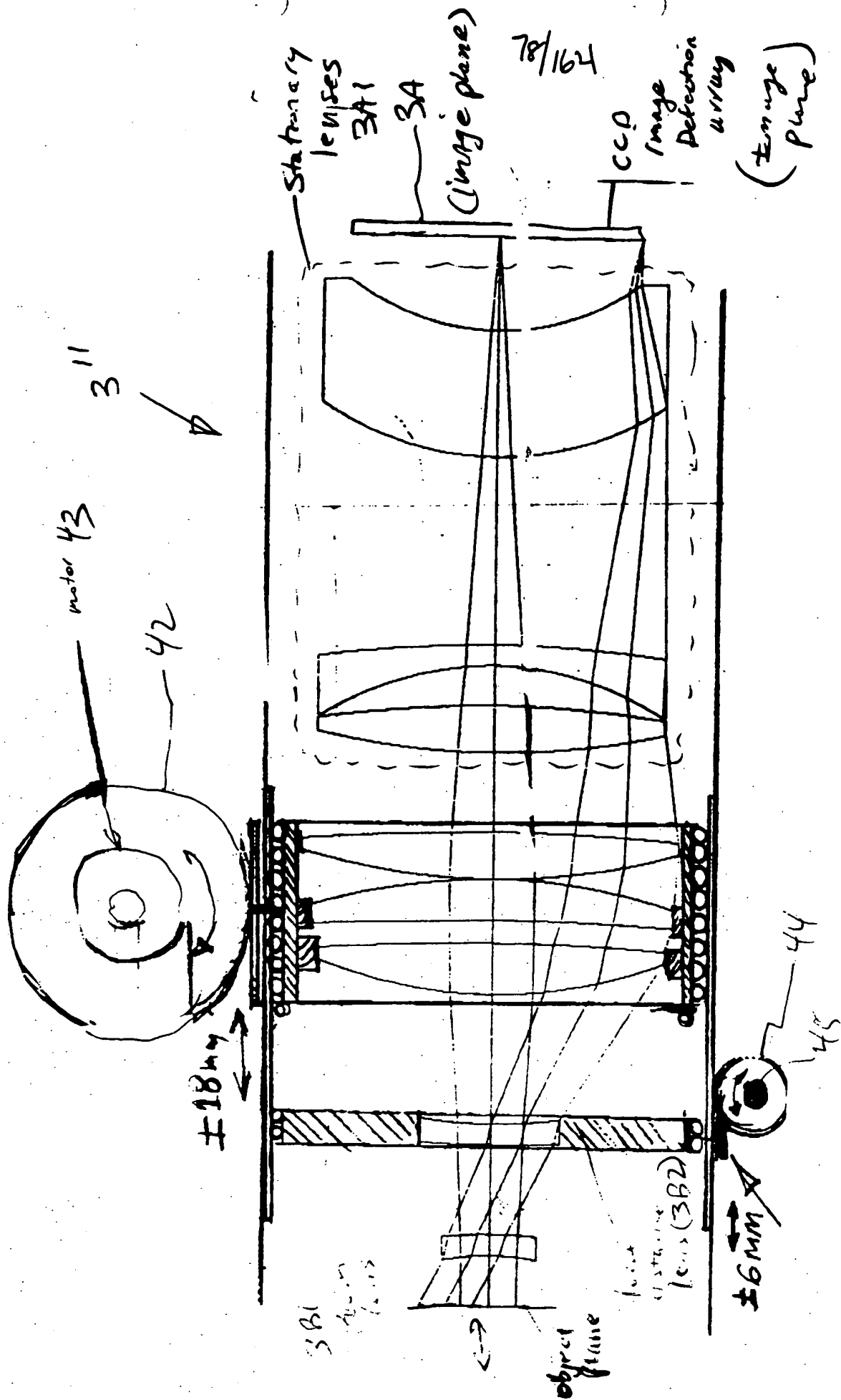
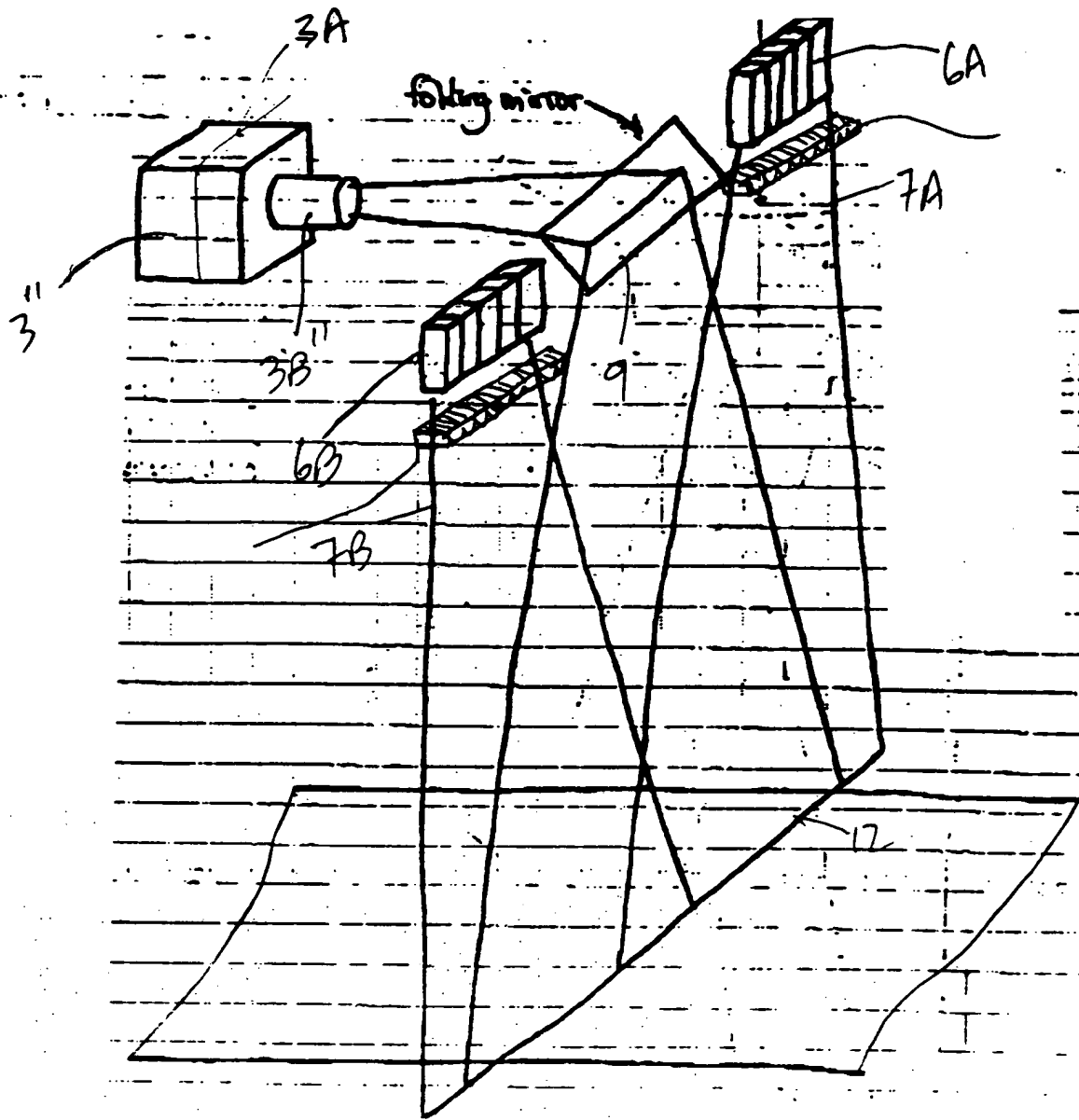


FIG. 3D

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FIG 3E1

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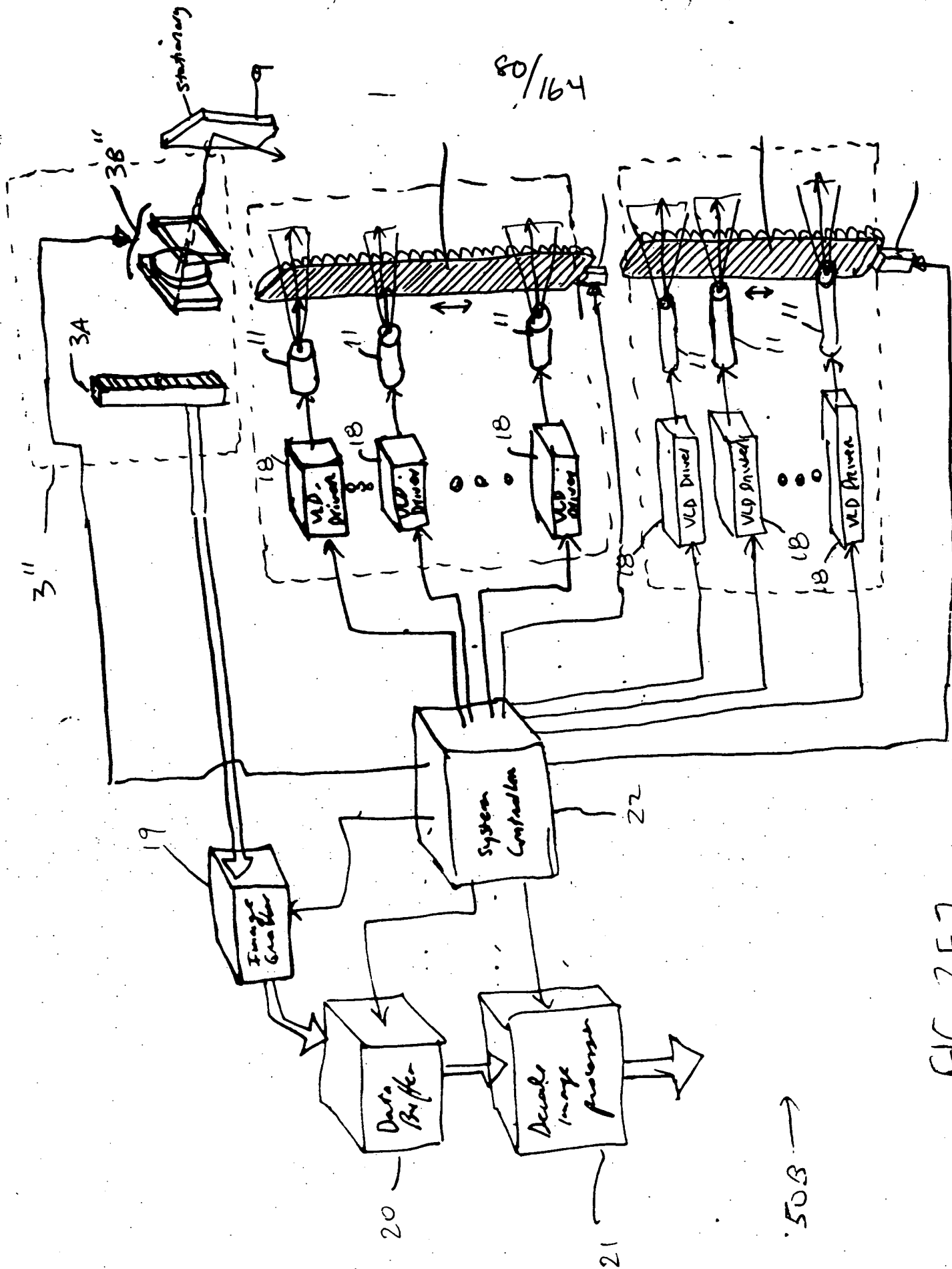


FIG. 3E2

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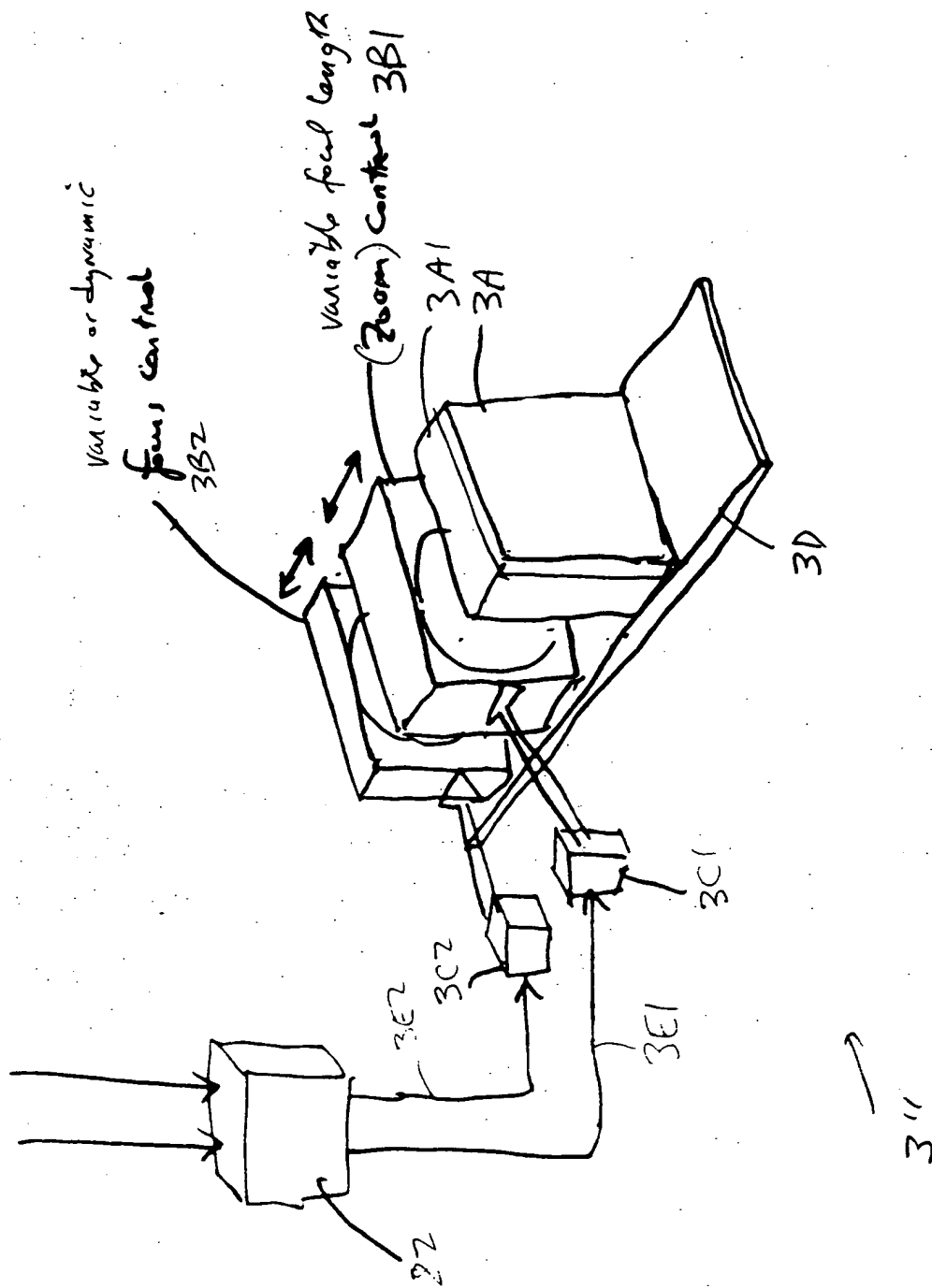


FIG. 3E3

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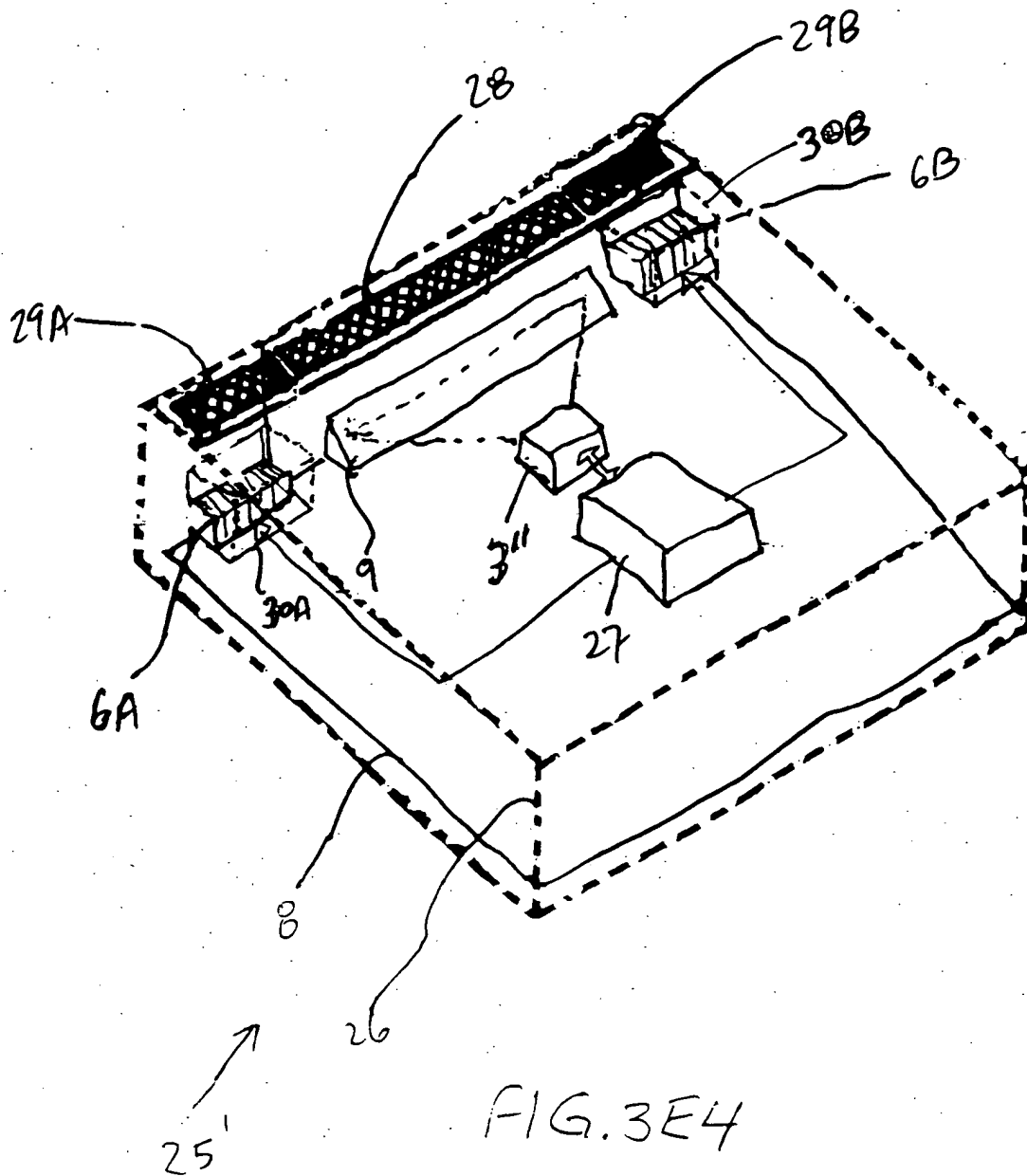


FIG. 3E4

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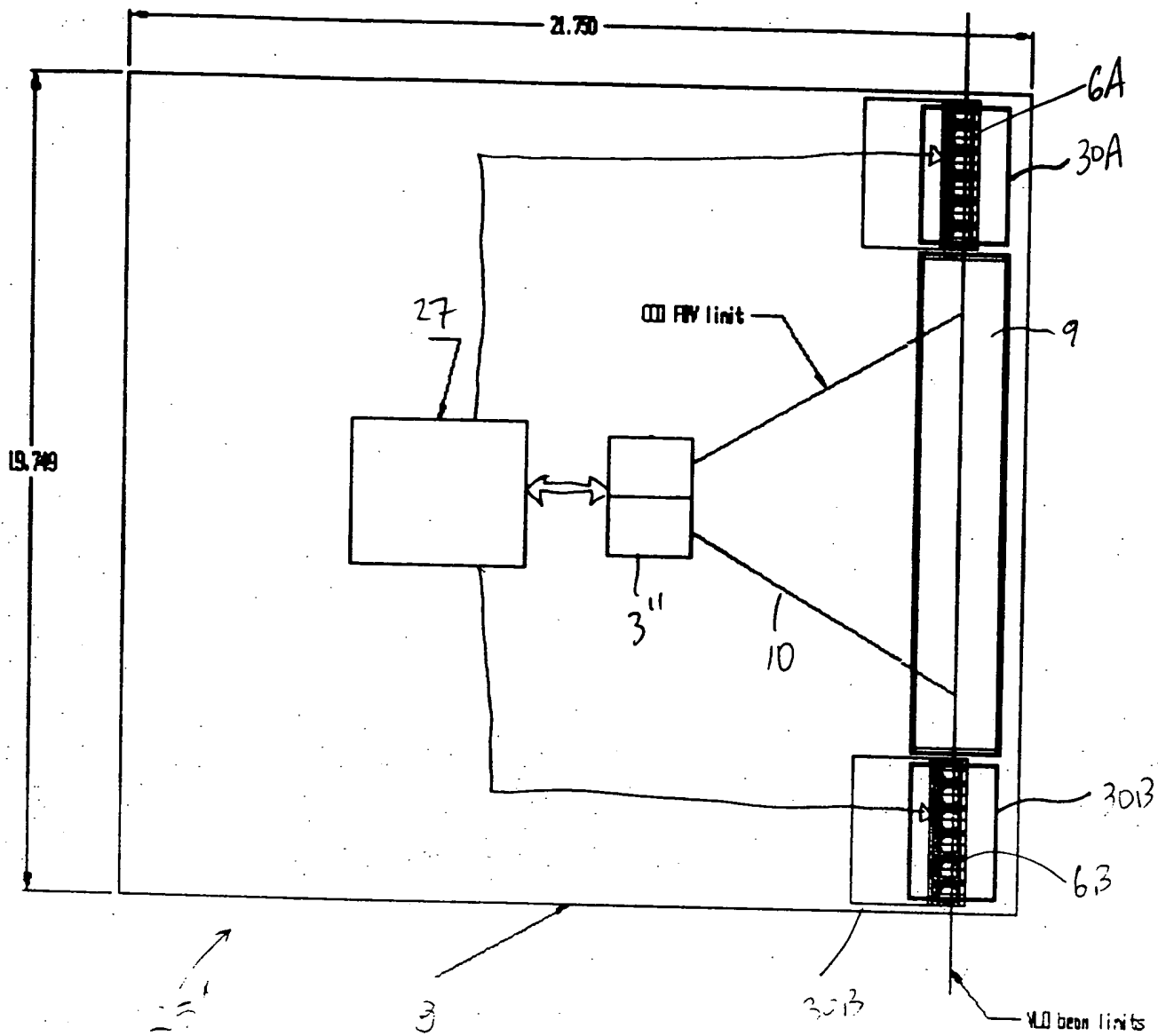


FIG. 3E5

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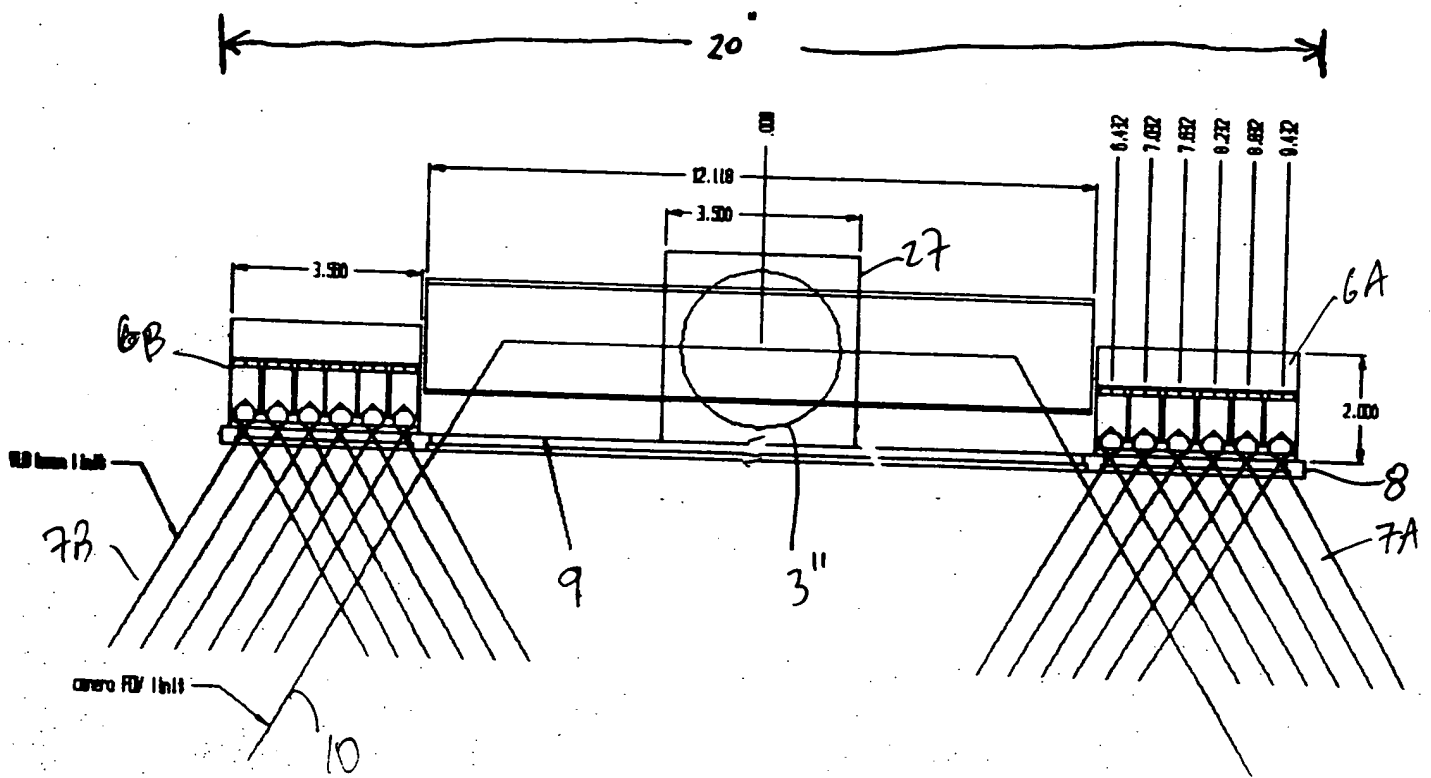


FIG. 3E6

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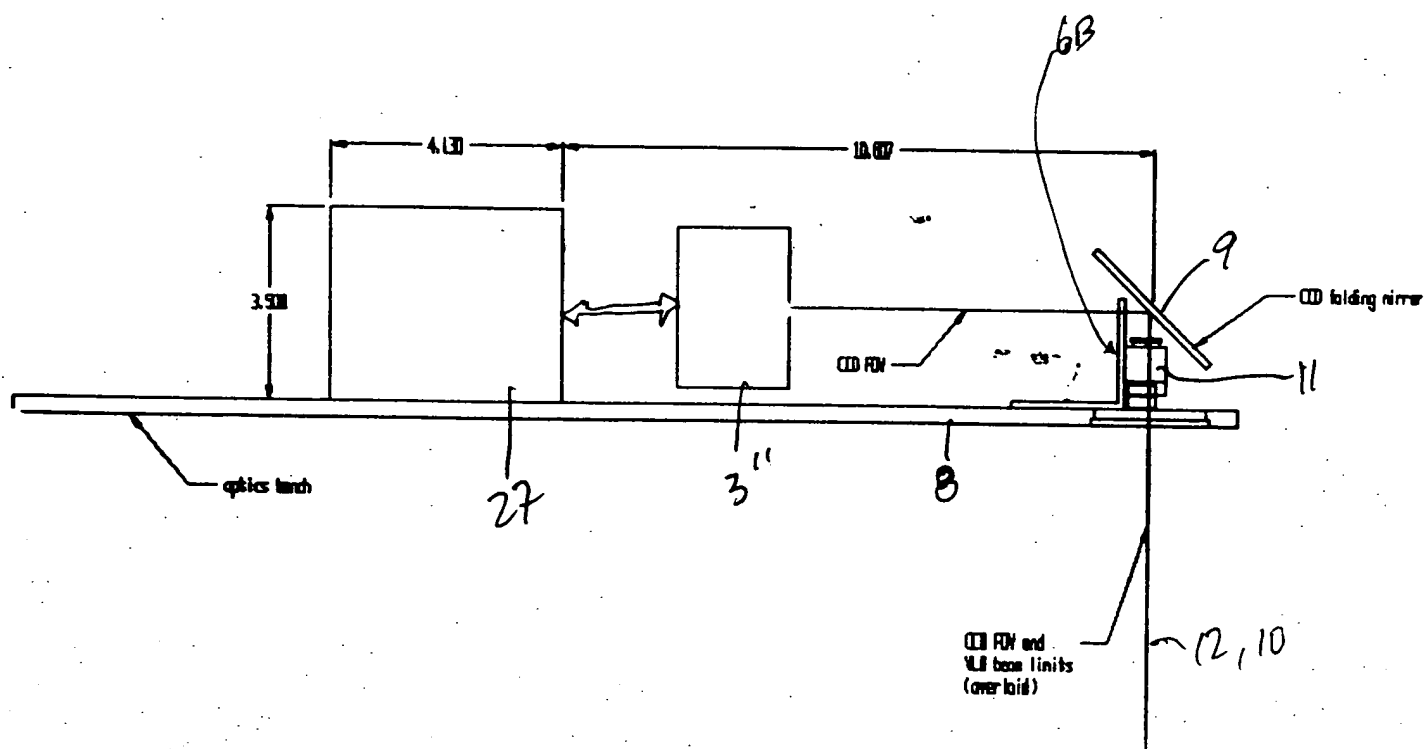


FIG 3E7

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*Variable FOV

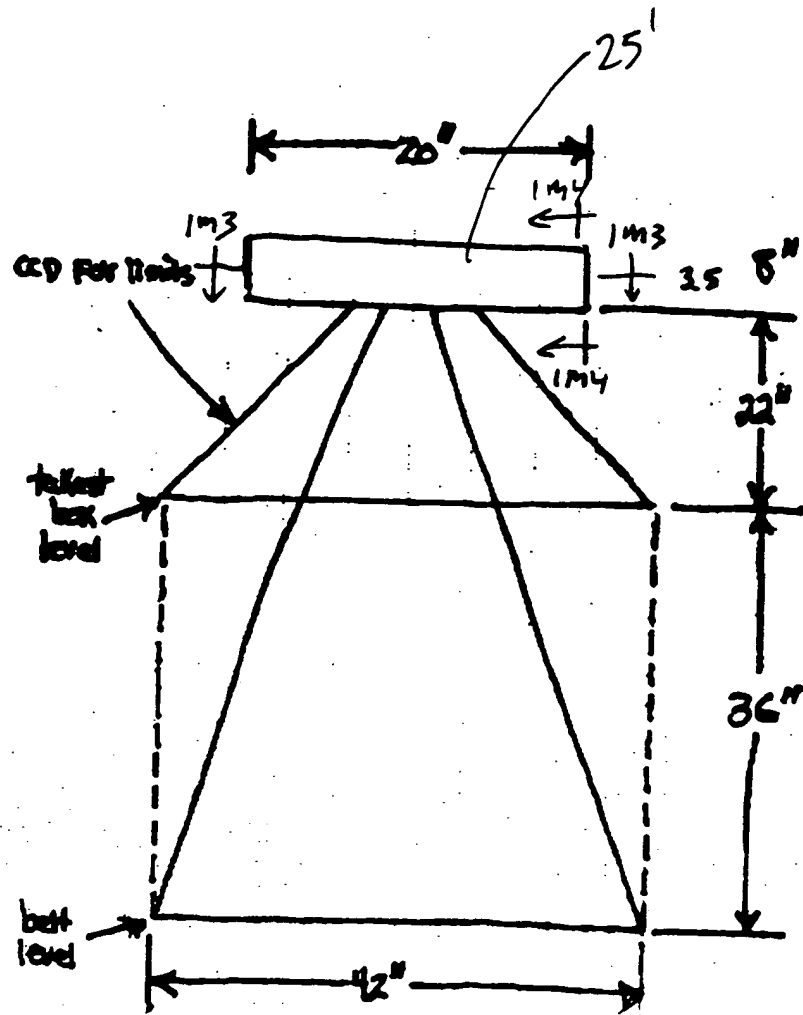


FIG. 3E8

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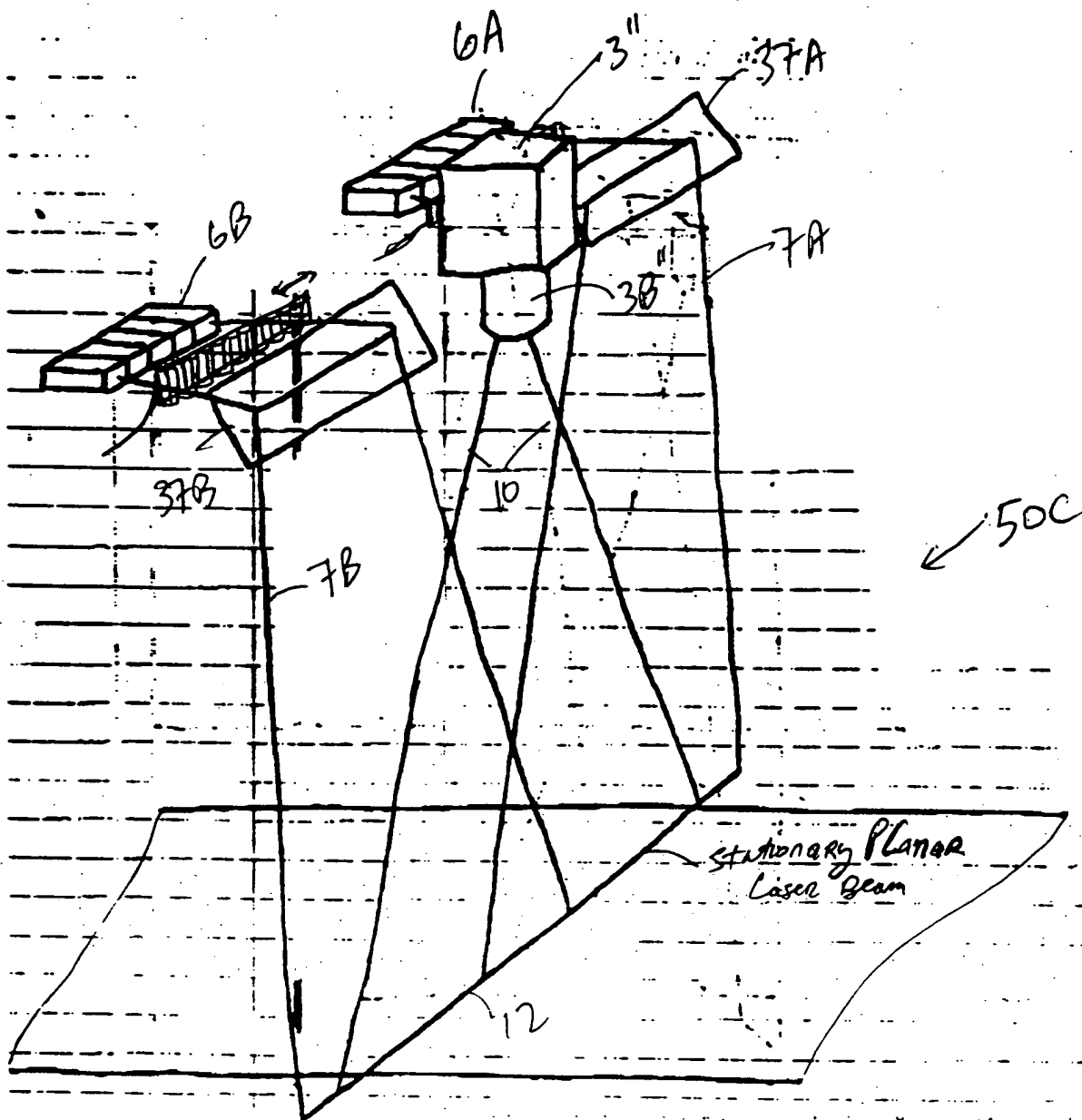


FIG. 3F1

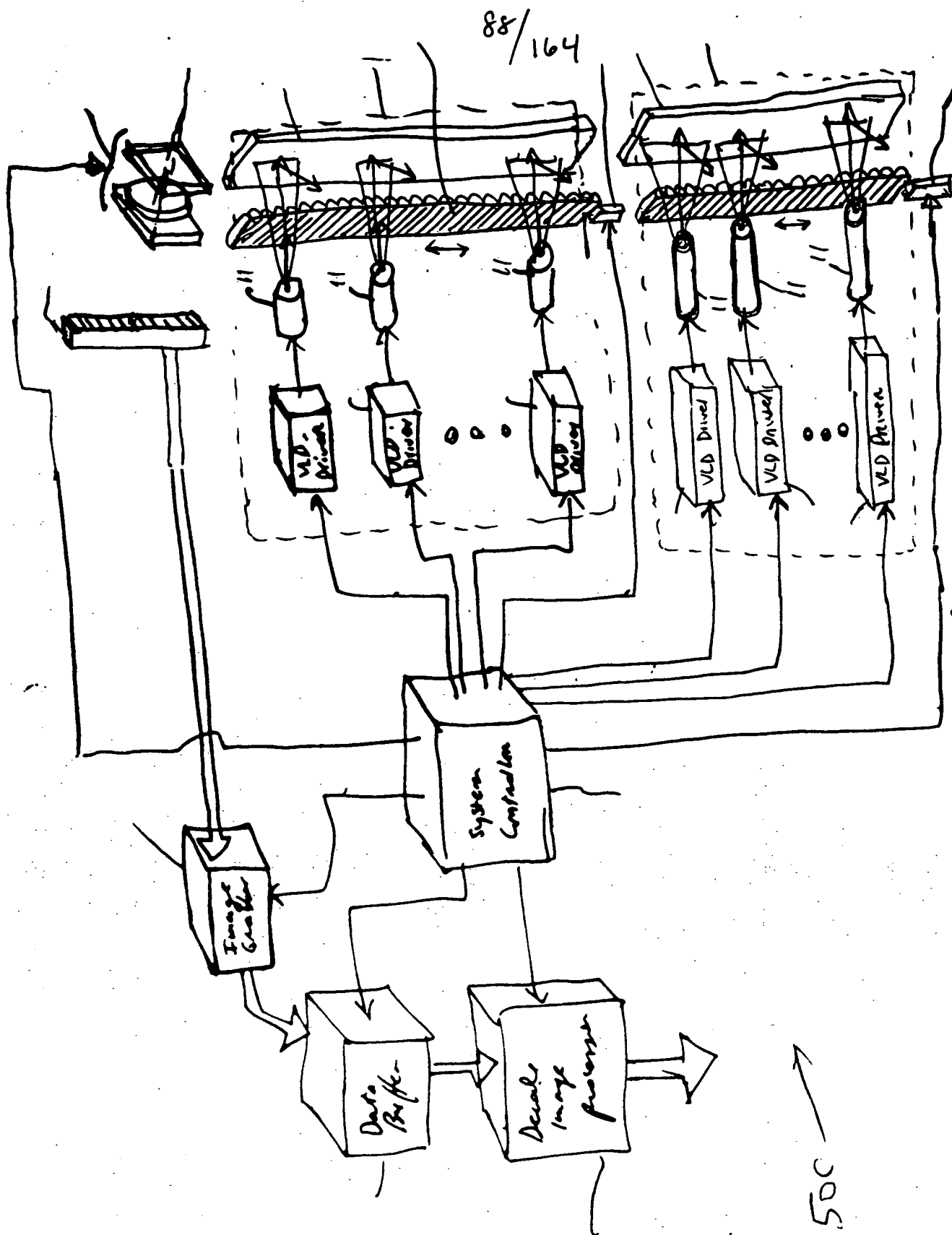


FIG. 3F2

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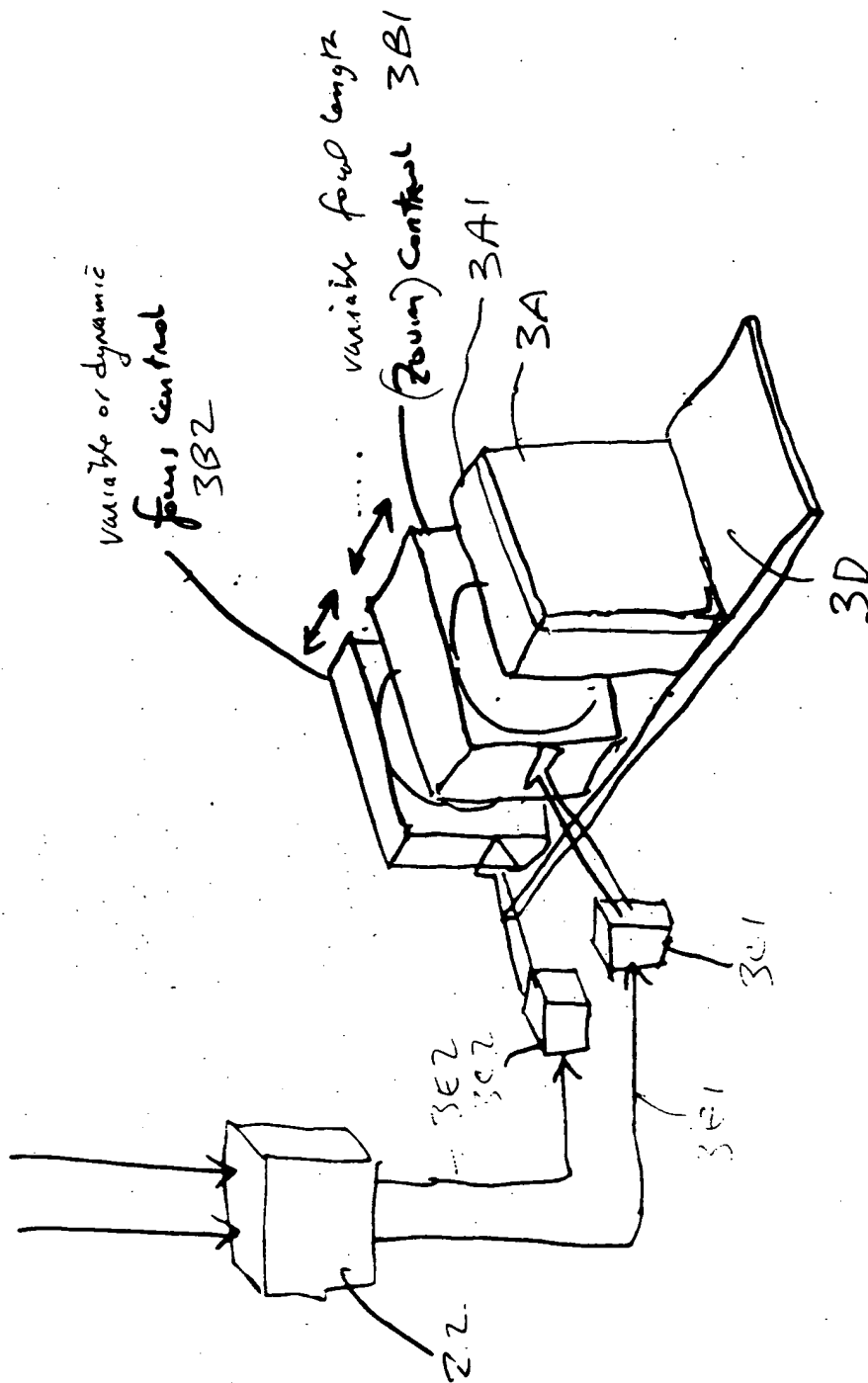


FIG. 3F3

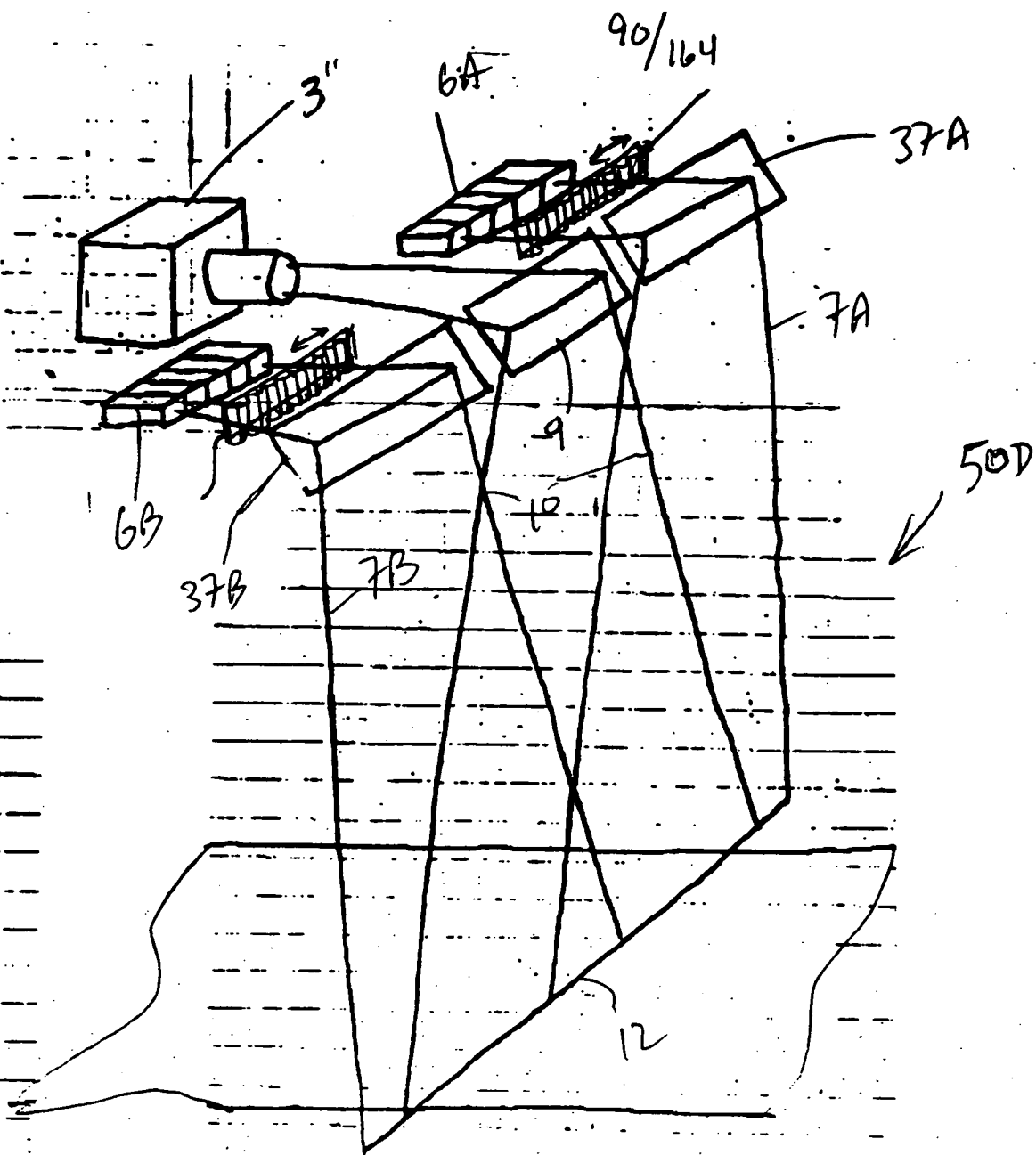


FIG. 3G1

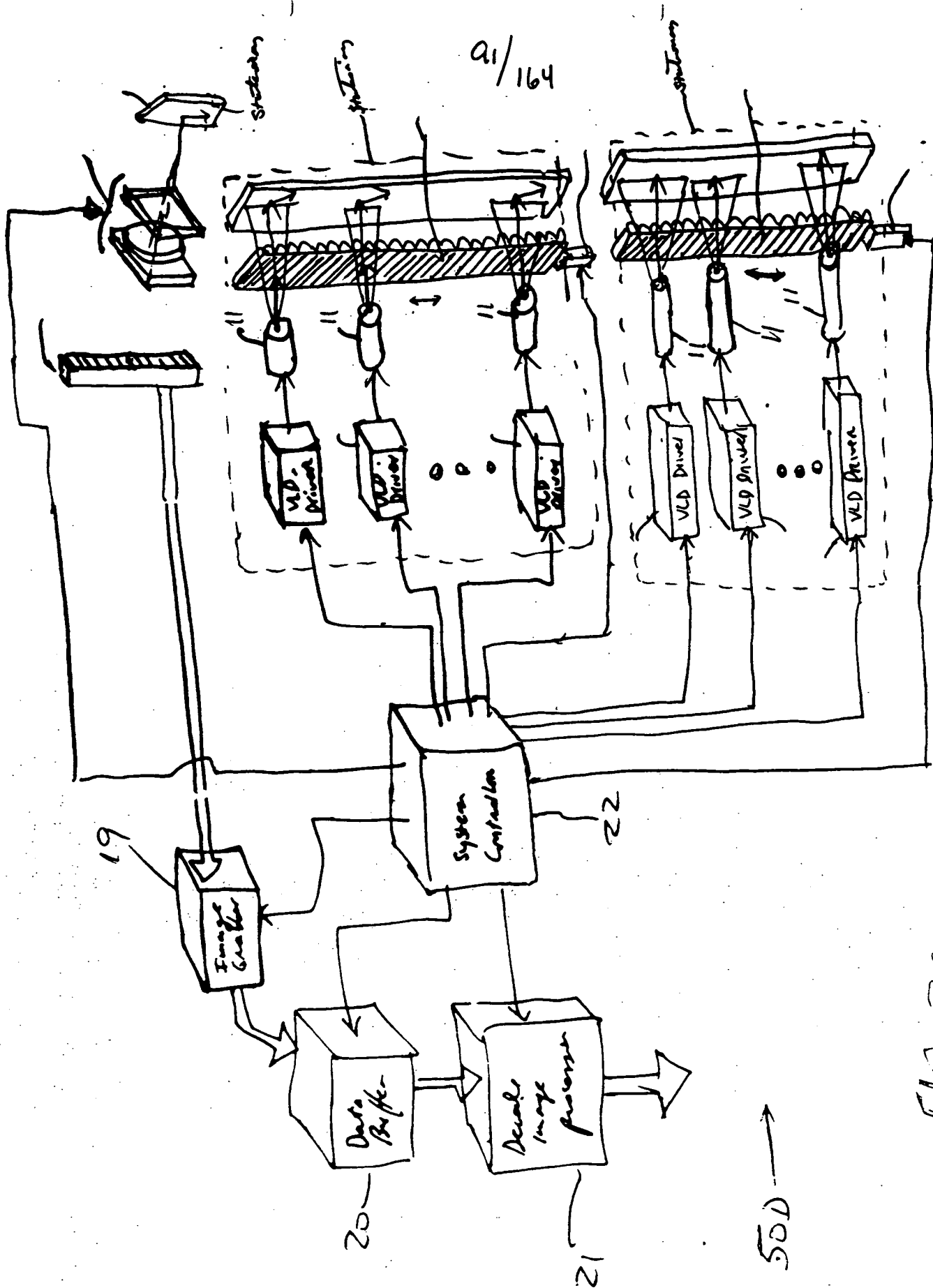


FIG 392

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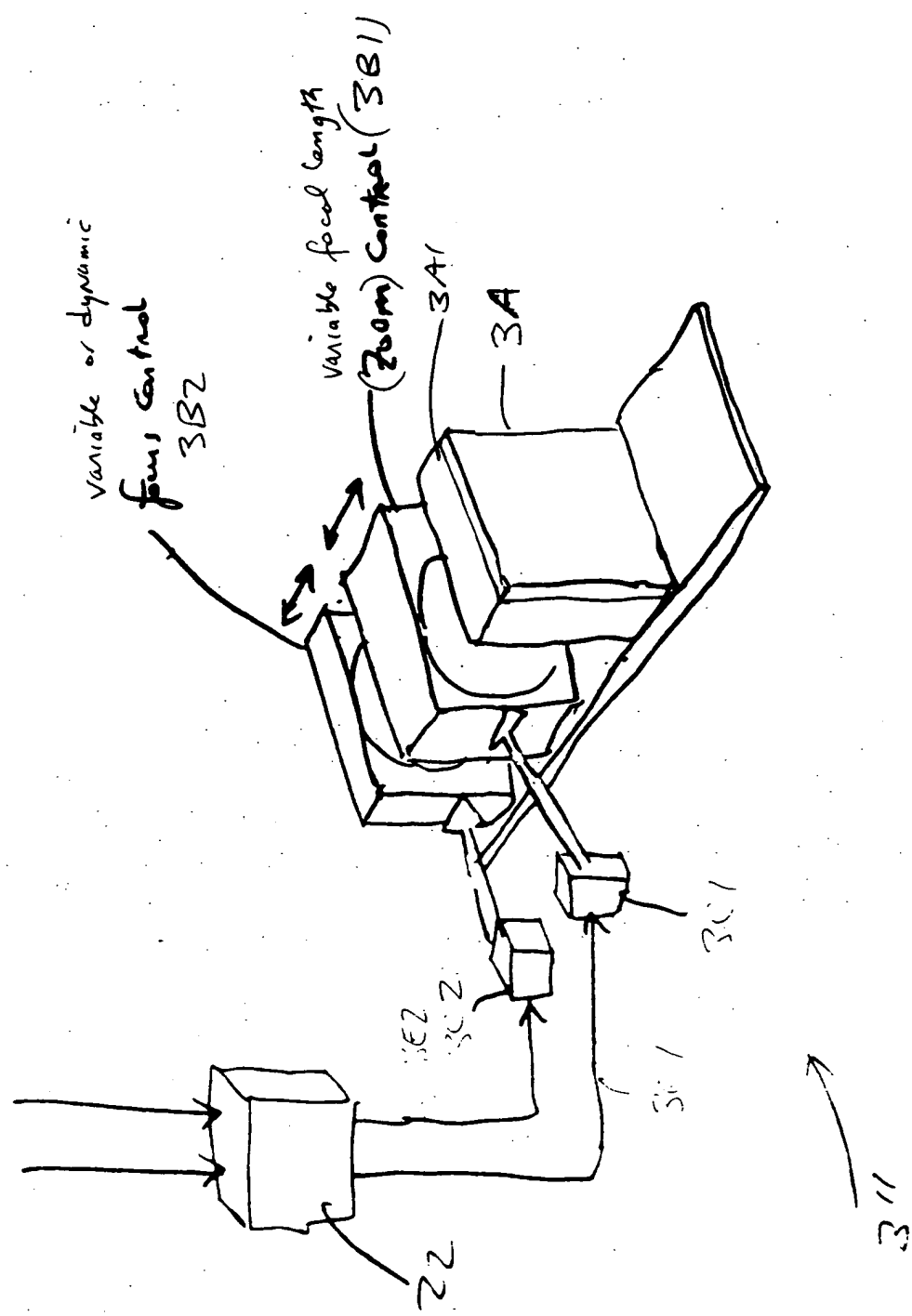


FIG. 3G3

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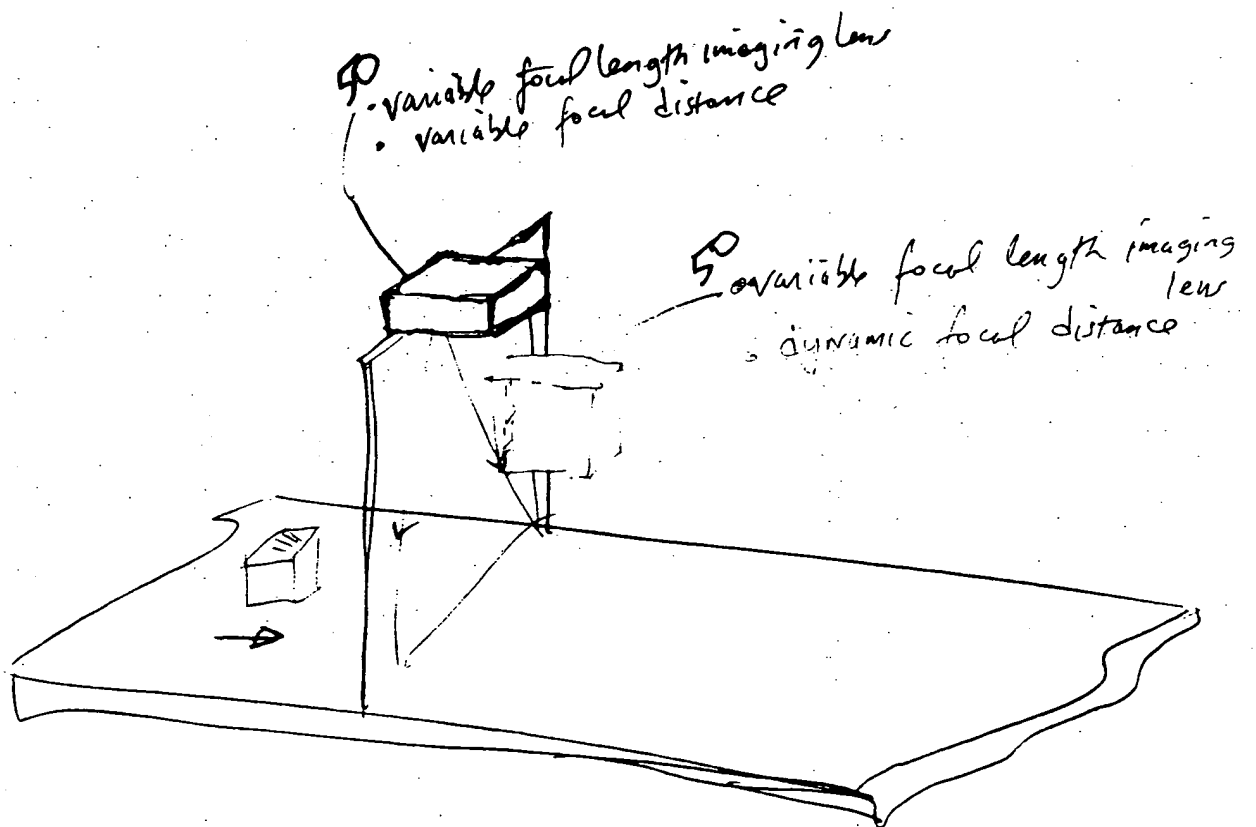


FIG. 3H

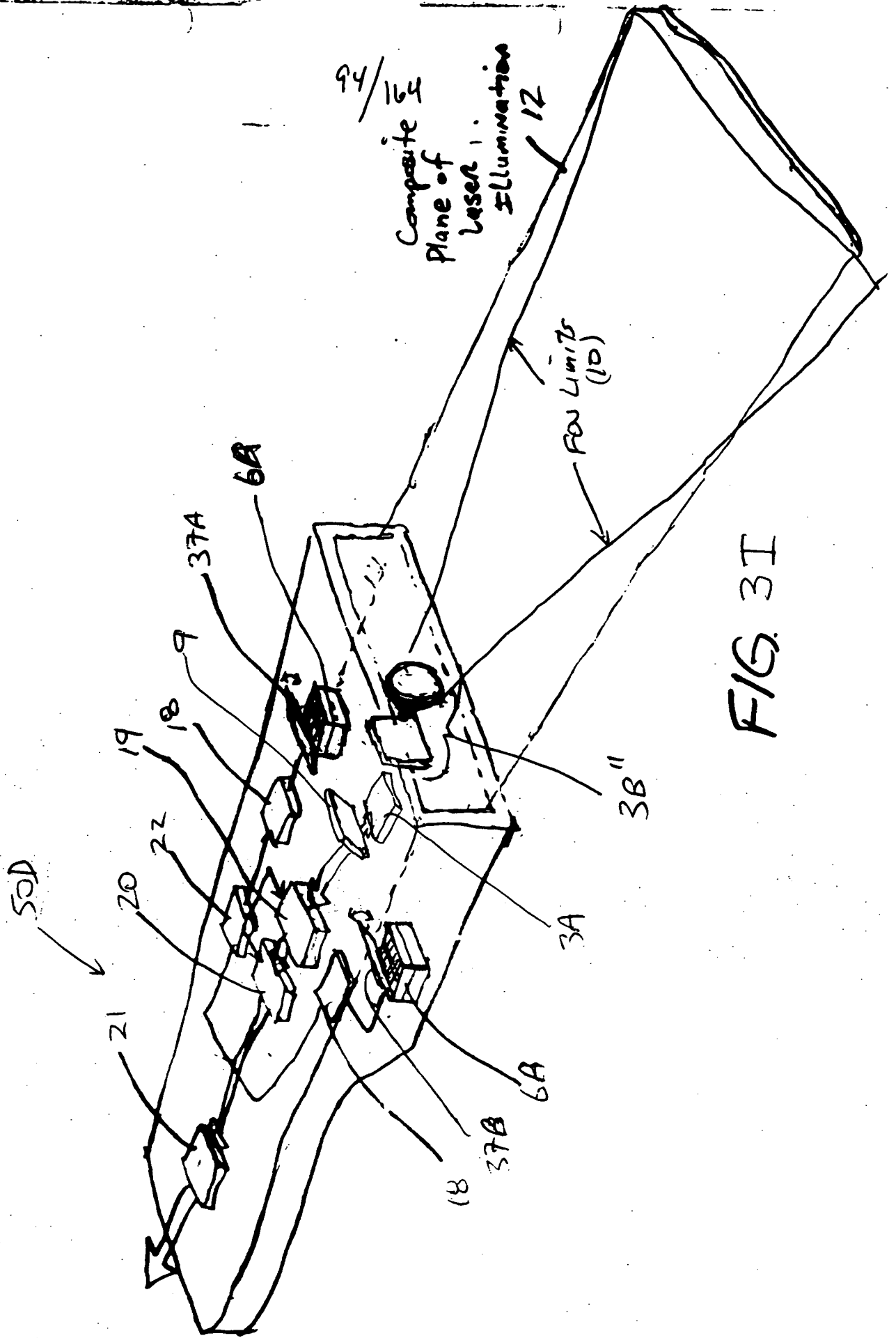


FIG. 3I

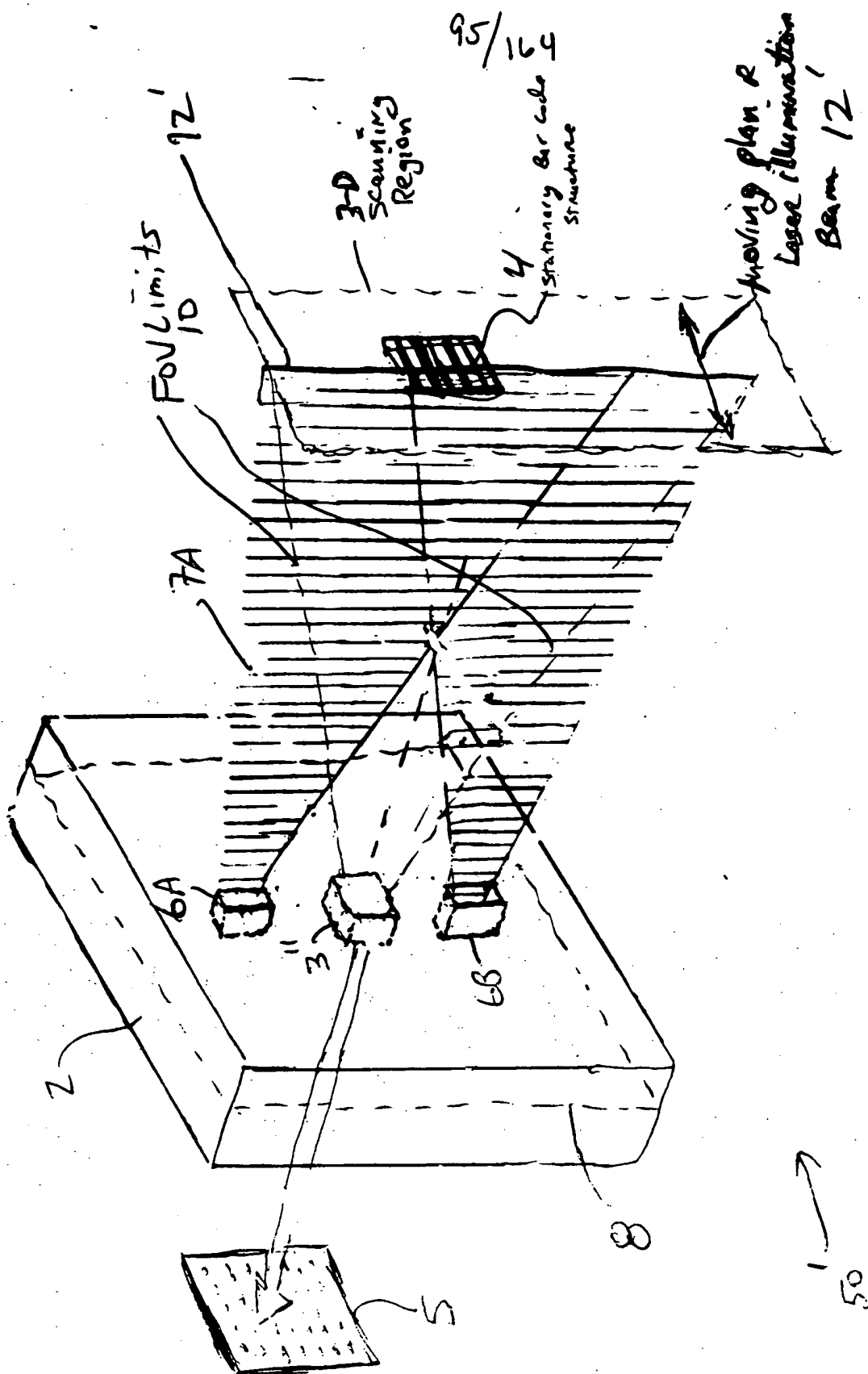


FIG. 351

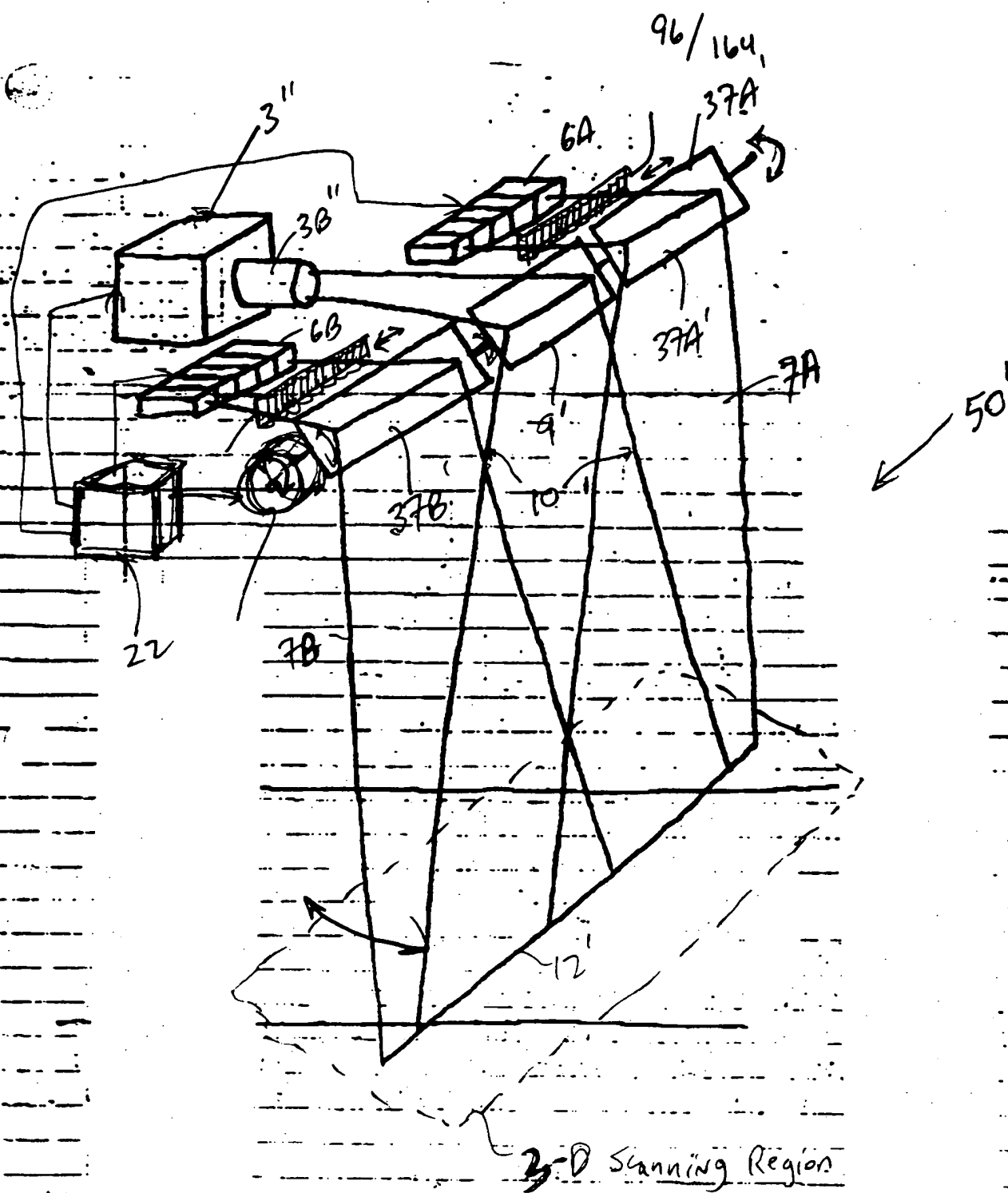


FIG. 3J2

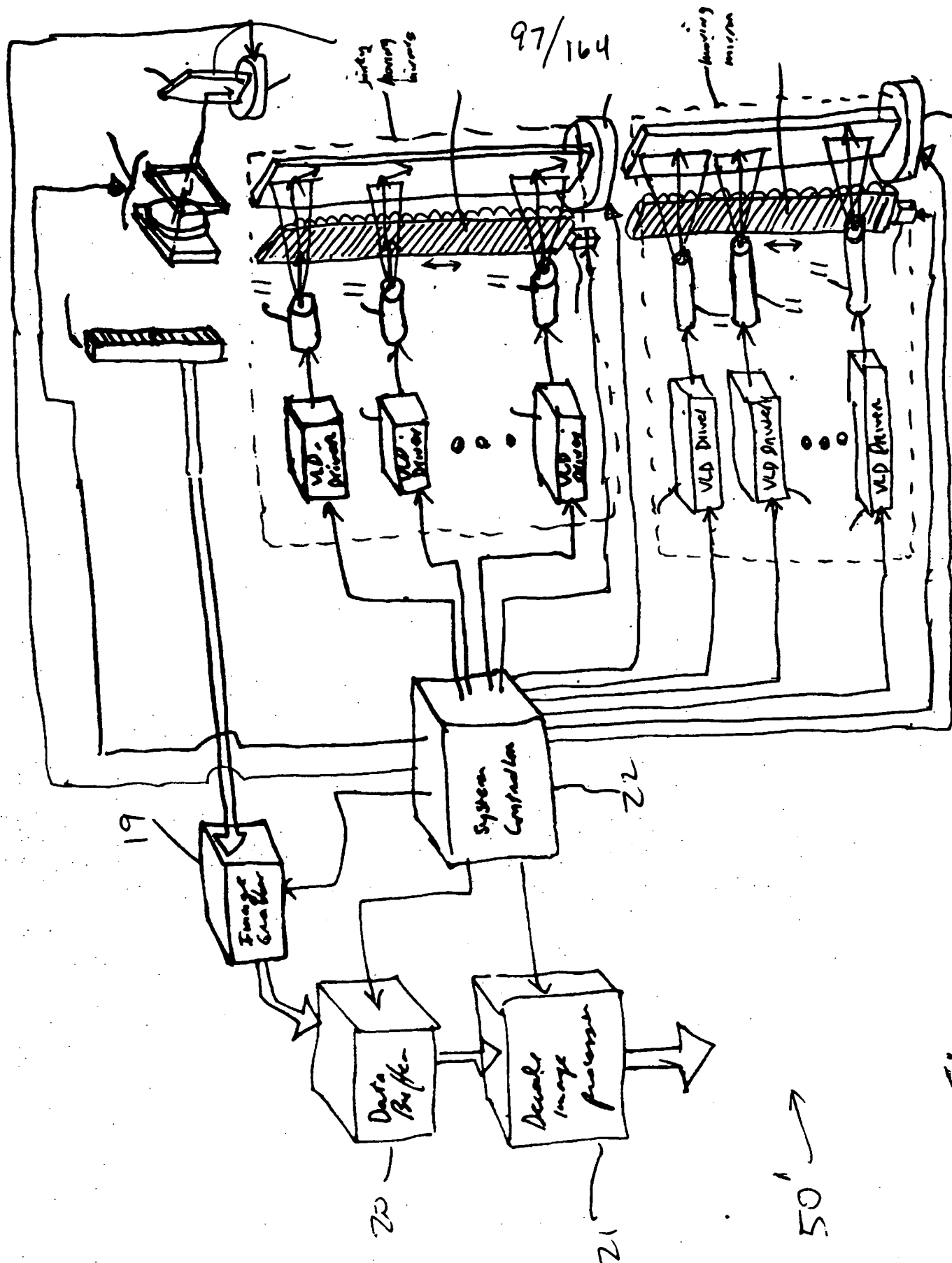


FIG. 313

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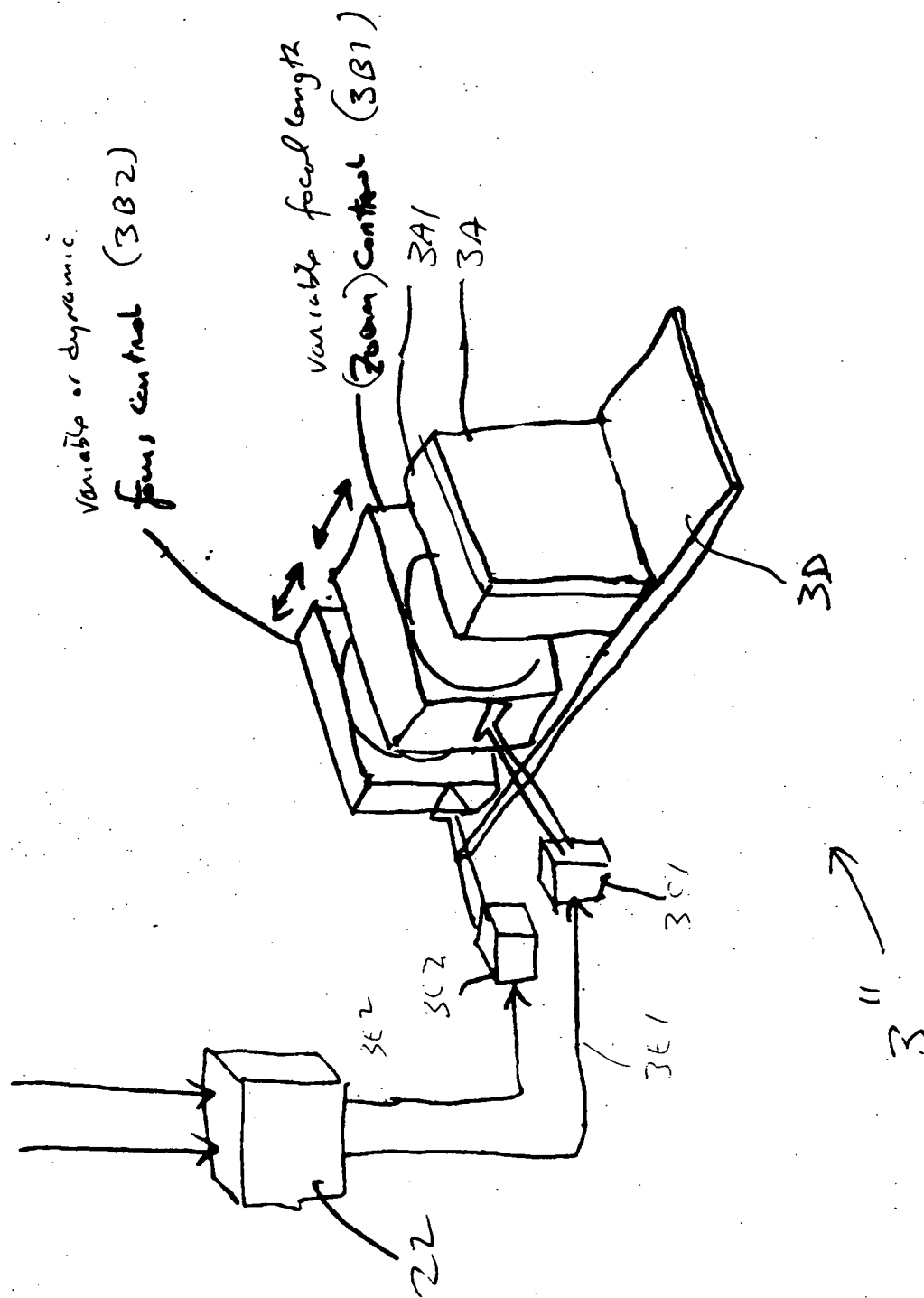


FIG. 354

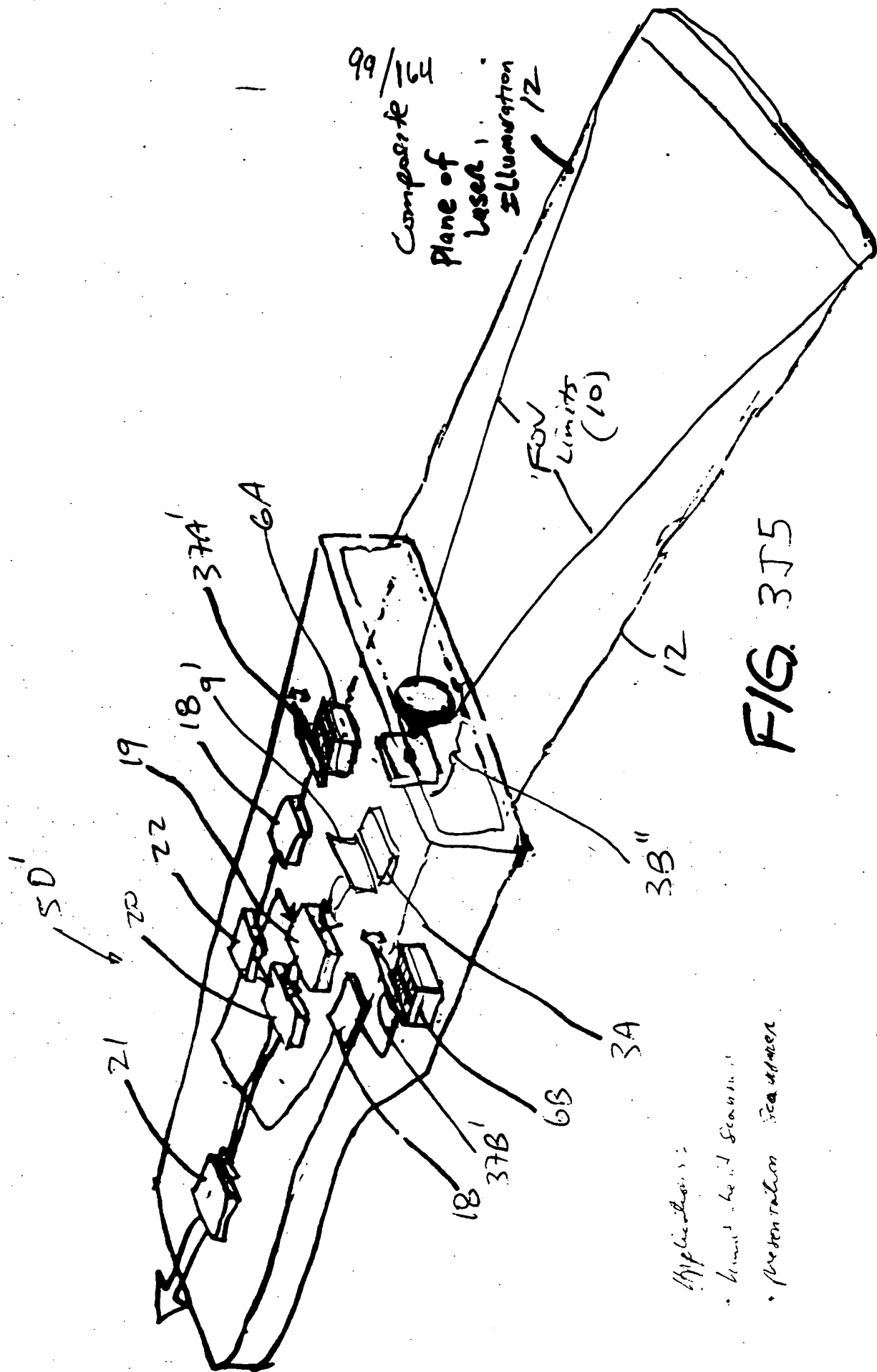
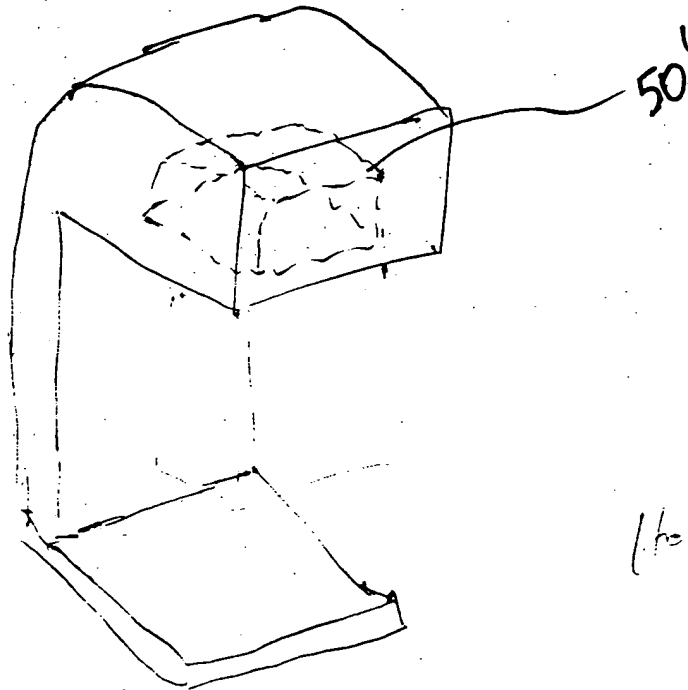


FIG. 3J5

- Applications:
- limit head search
 - presentation features

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Composite
Plane of
Laser
Illumination
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2-D
hold-up
scanner

FIG. 318

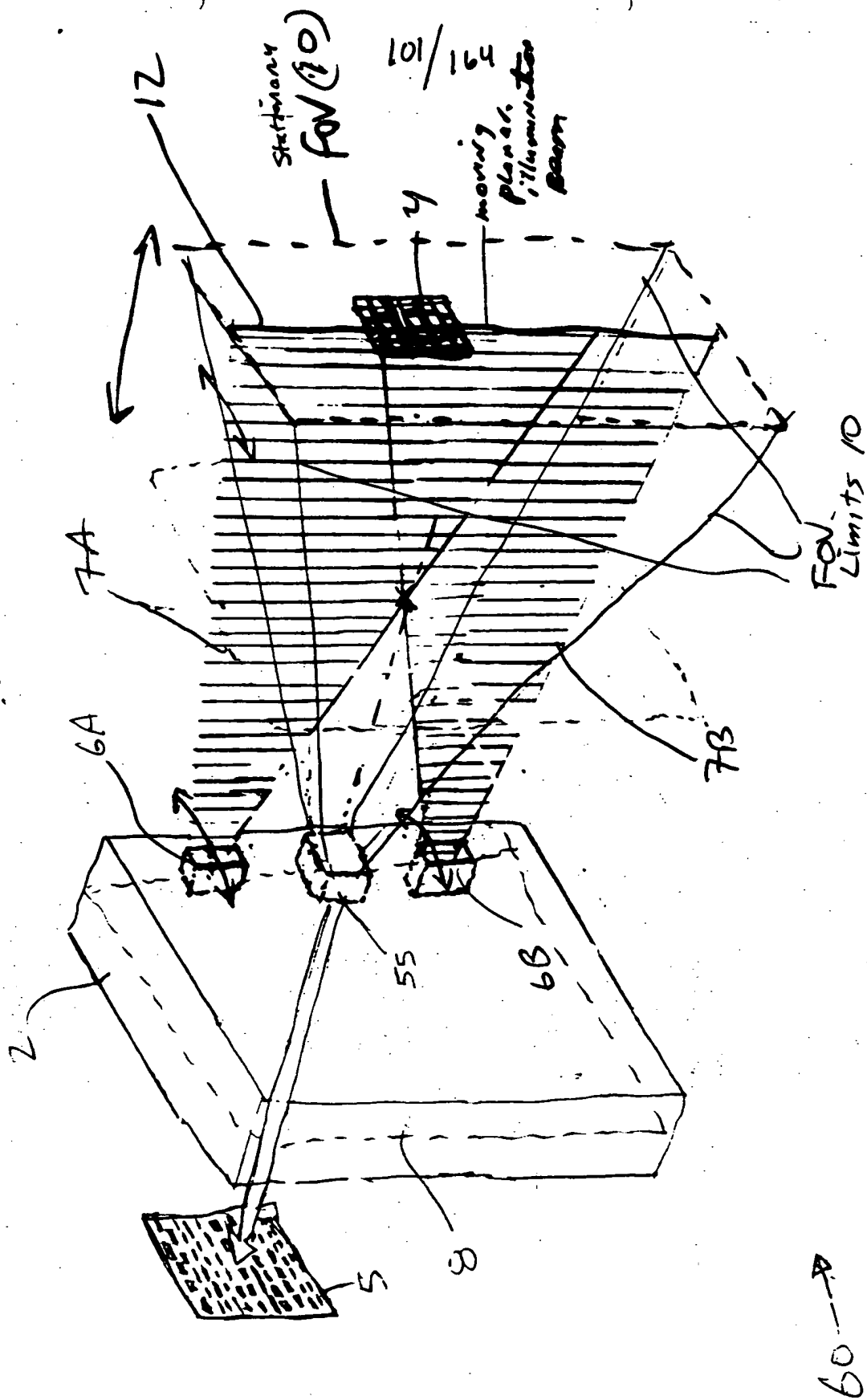


FIG 4A

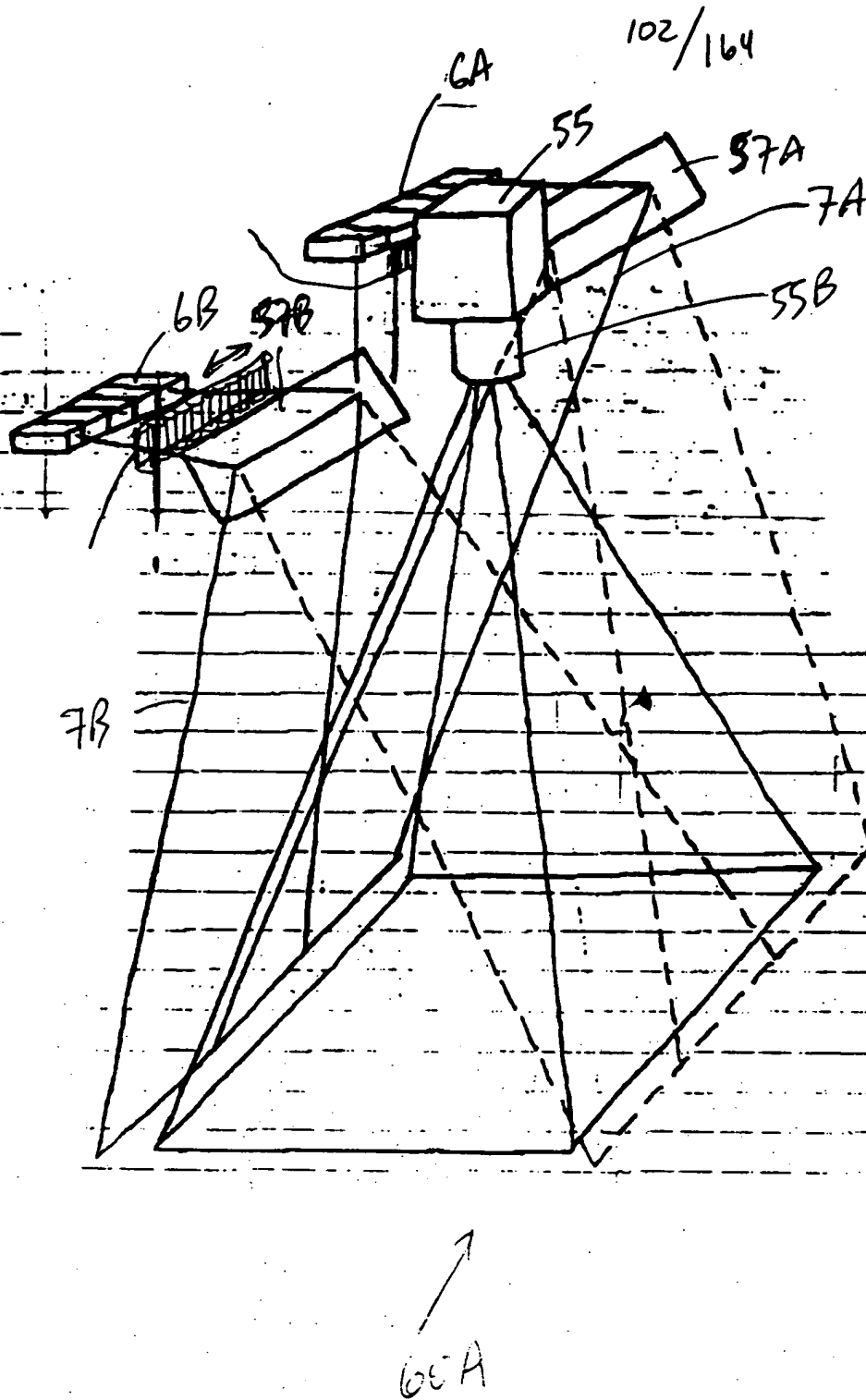
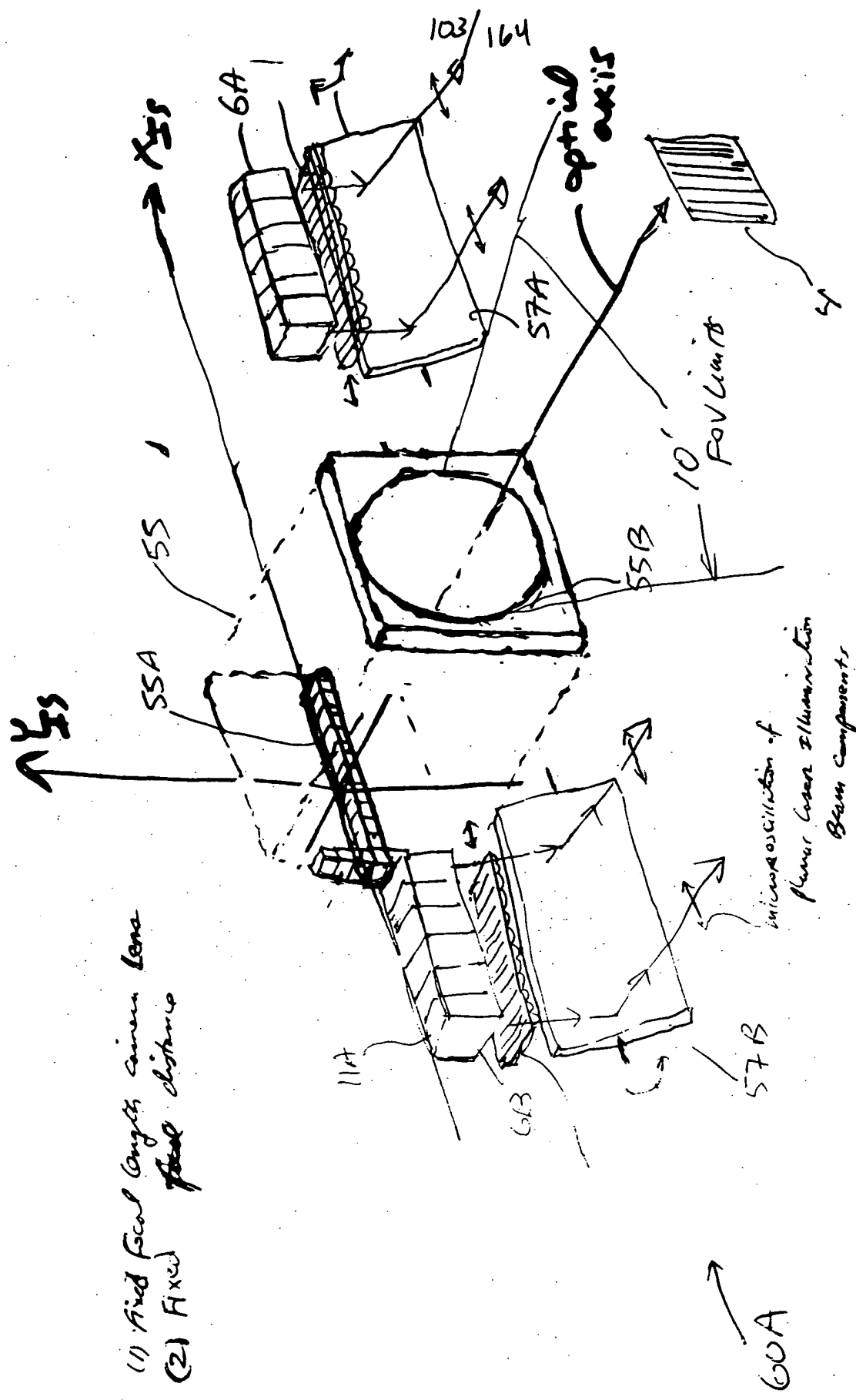
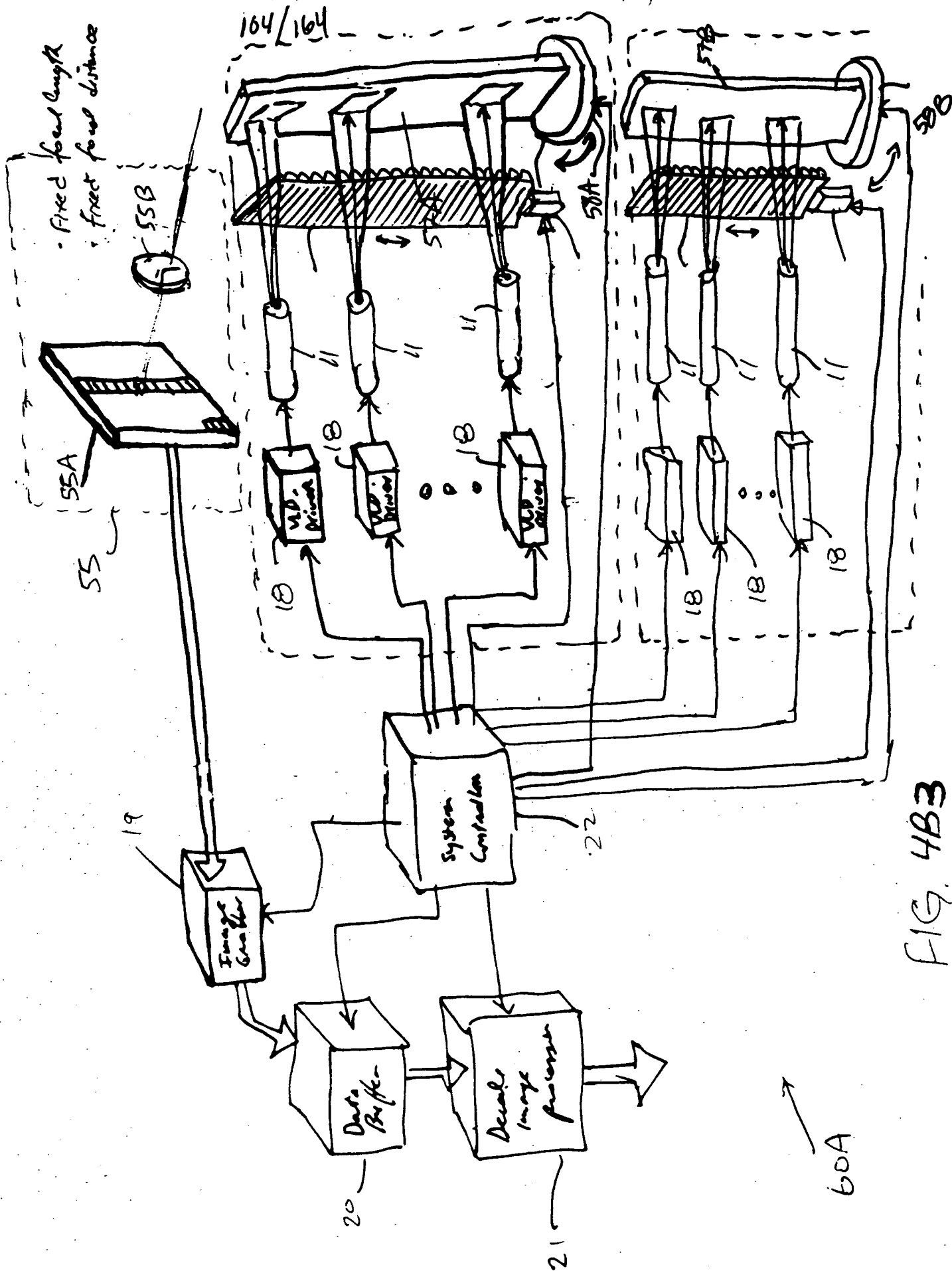


FIG. 4B1



- (1) Fixed focal length camera lens
- (2) Fixed focal distance

FIG. 4BZ



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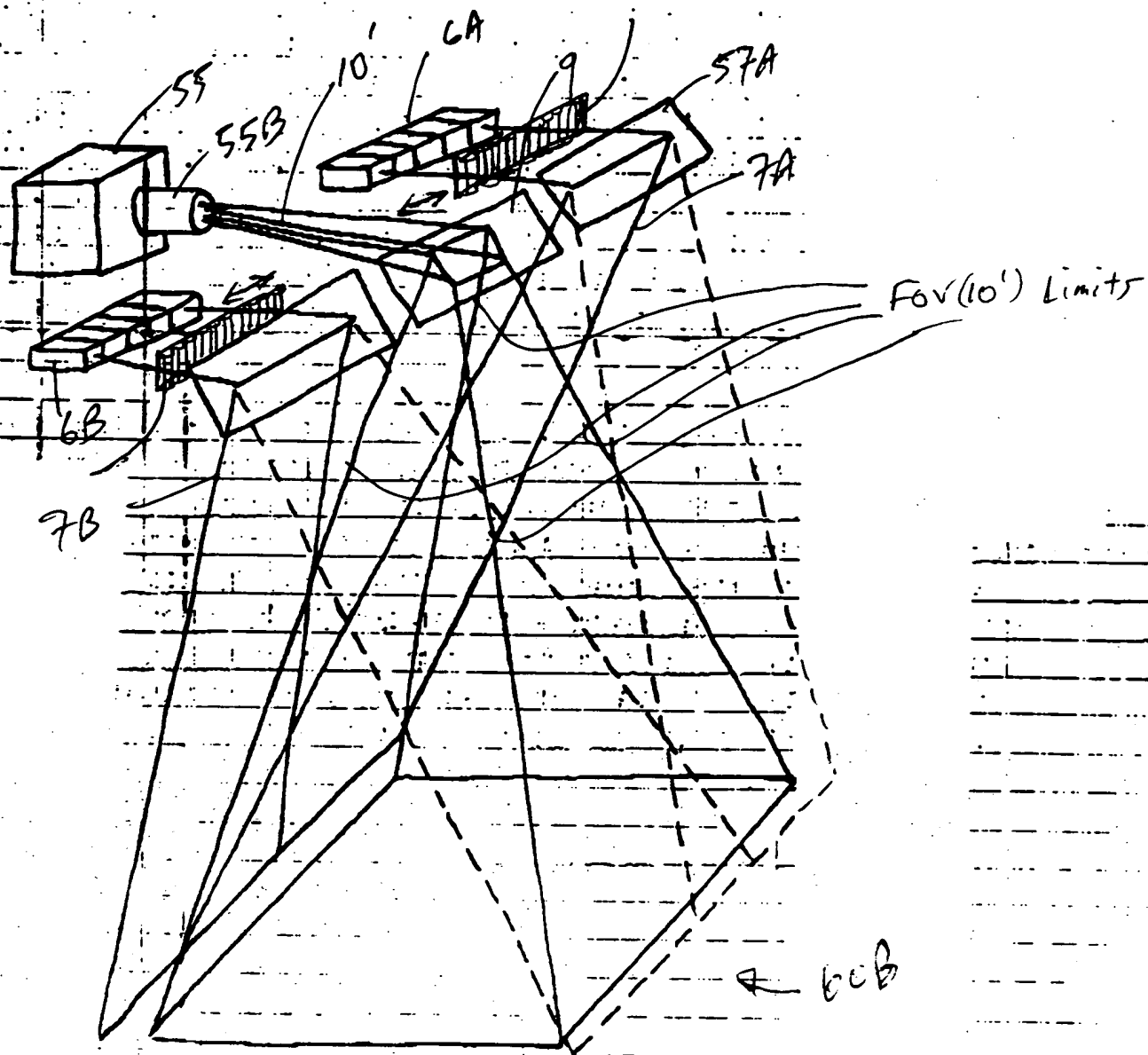
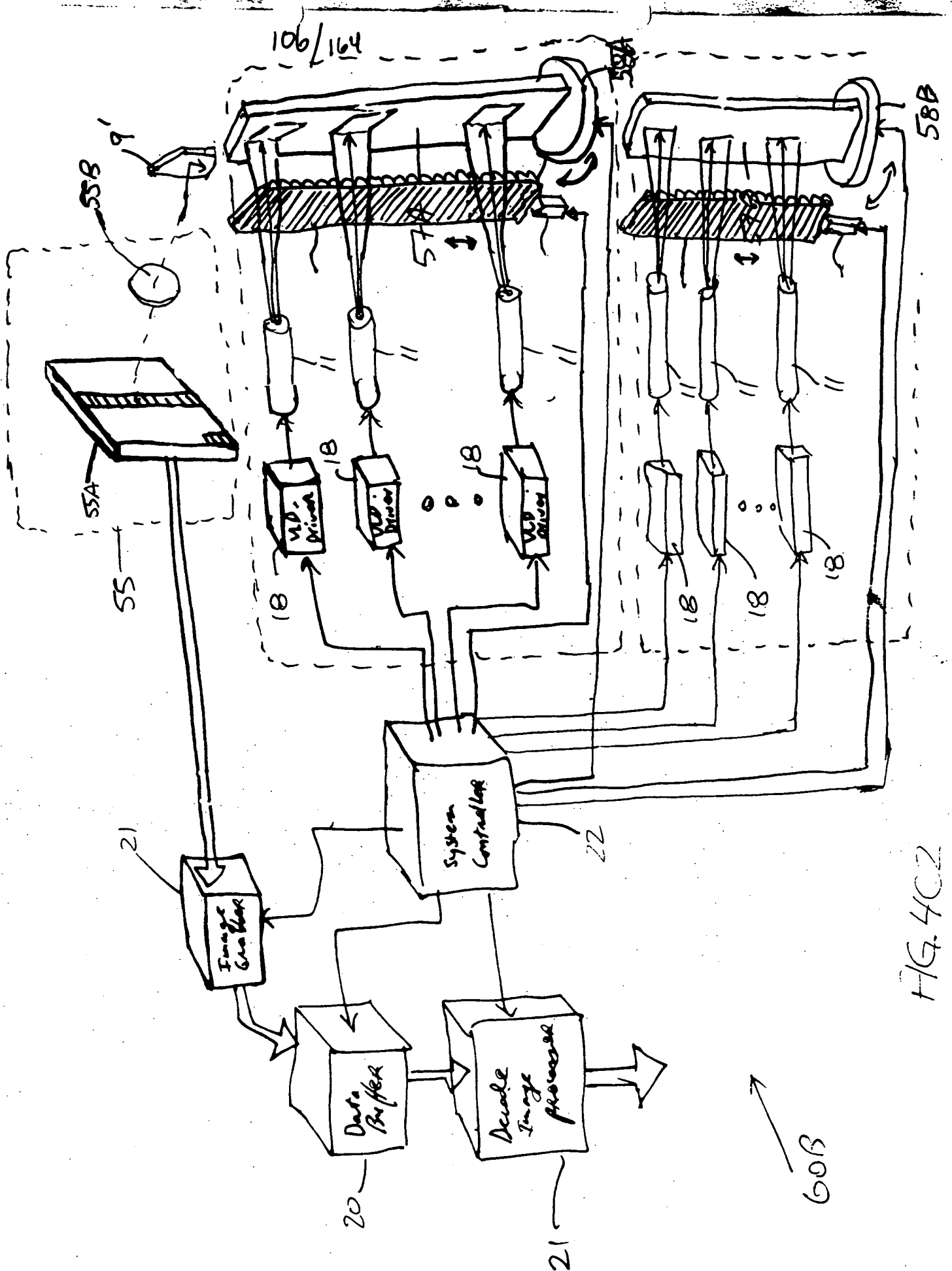


FIG. 4C1



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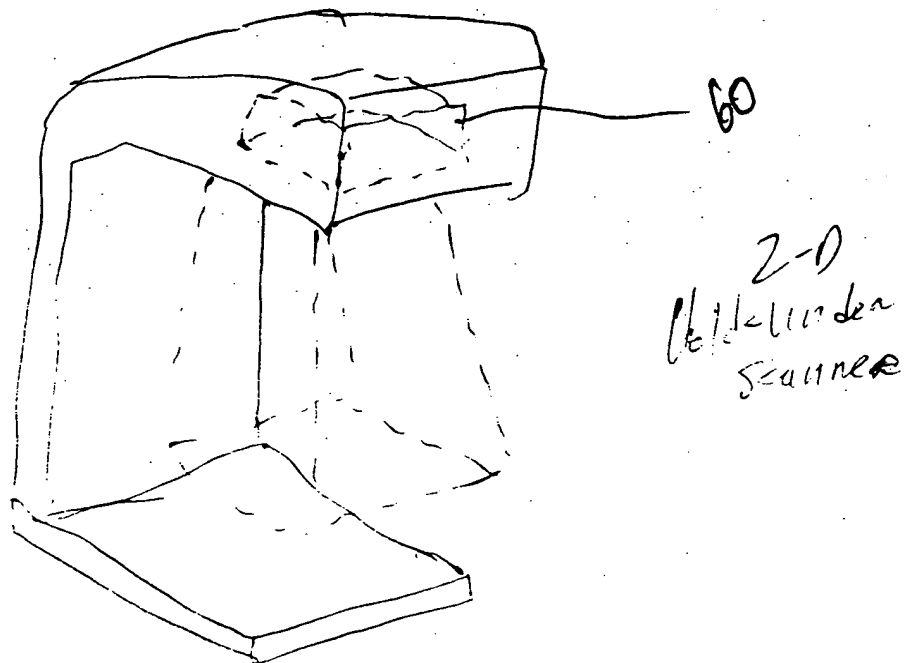


FIG. 4D

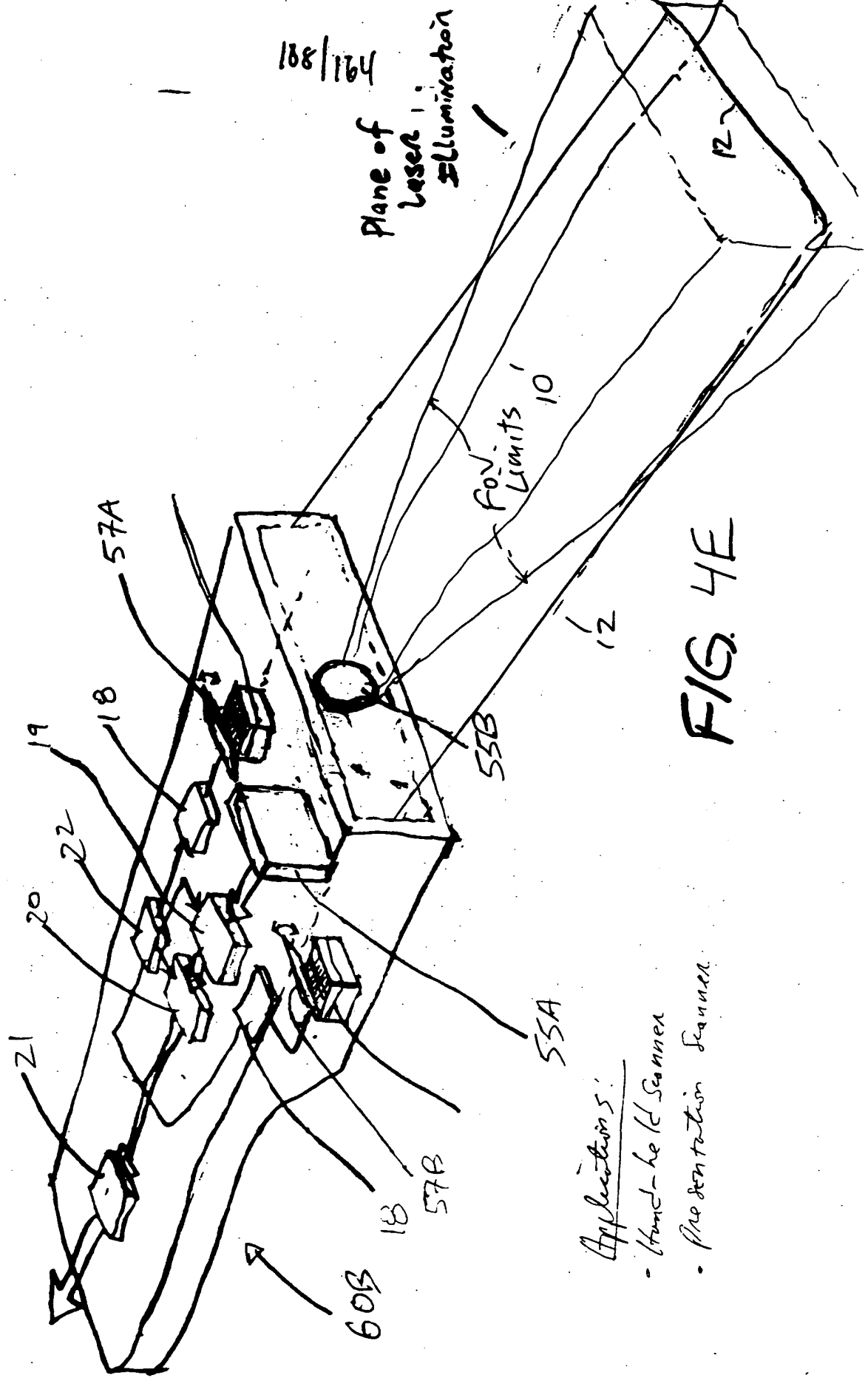


FIG. 4E

Applications:

- Hand-held Scanner
- Presentation Scanner

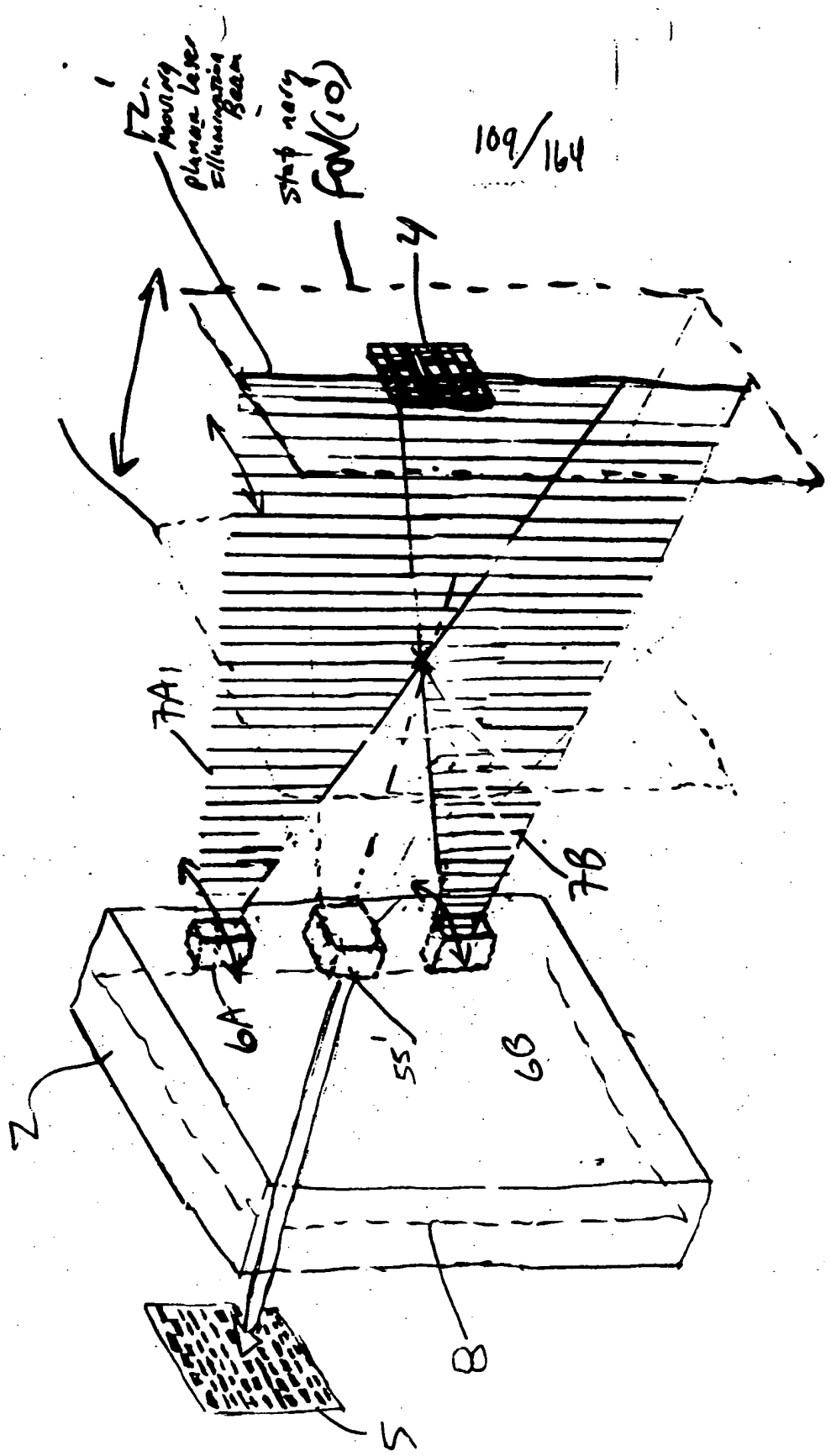


FIG. 5A

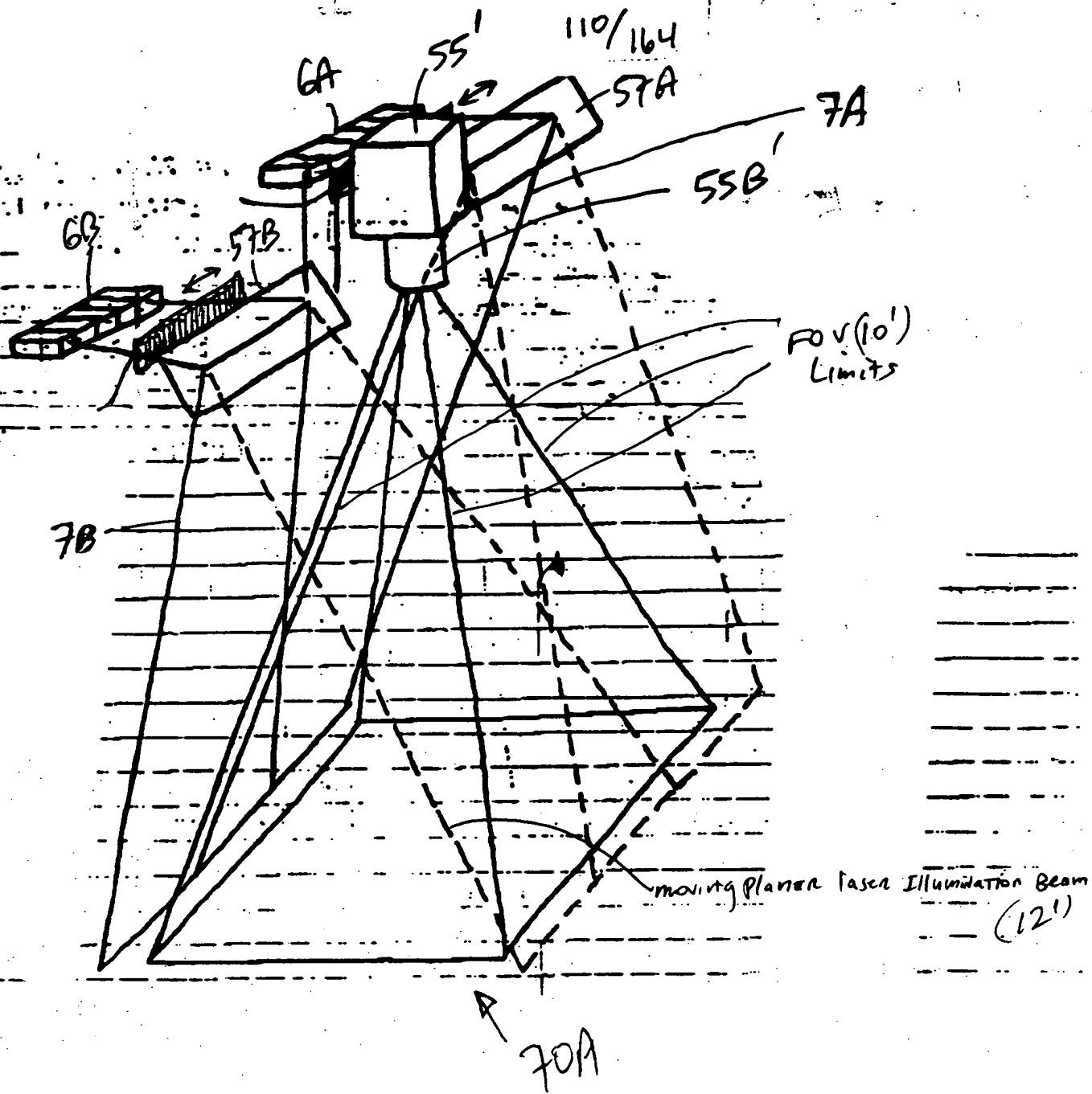


FIG 5B1

Hand-drawn schematic diagram of an optical system. The diagram shows two lenses, 55A and 55B, positioned along an optical axis. Lens 55A is on the left, and lens 55B is on the right. The optical axis is labeled (FOV) and has a focal length f indicated. The focal planes are labeled 6A and 70A for lens 55A, and 6B and 70B for lens 55B. The diagram also shows coordinate axes x and y . The focal length f is also labeled for lens 55B. The diagram is labeled III/164.

FIG. 5B2

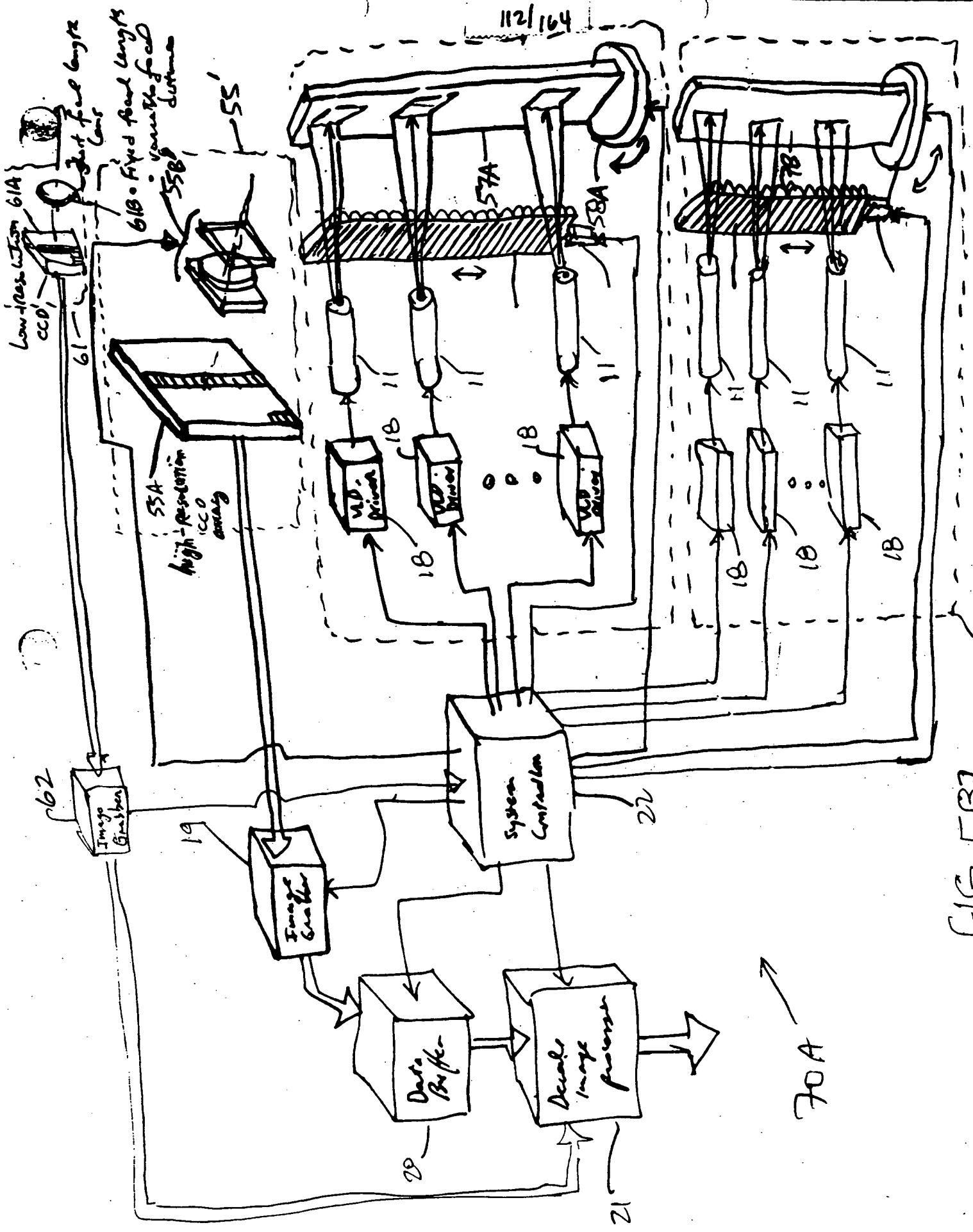


FIG. 5B3

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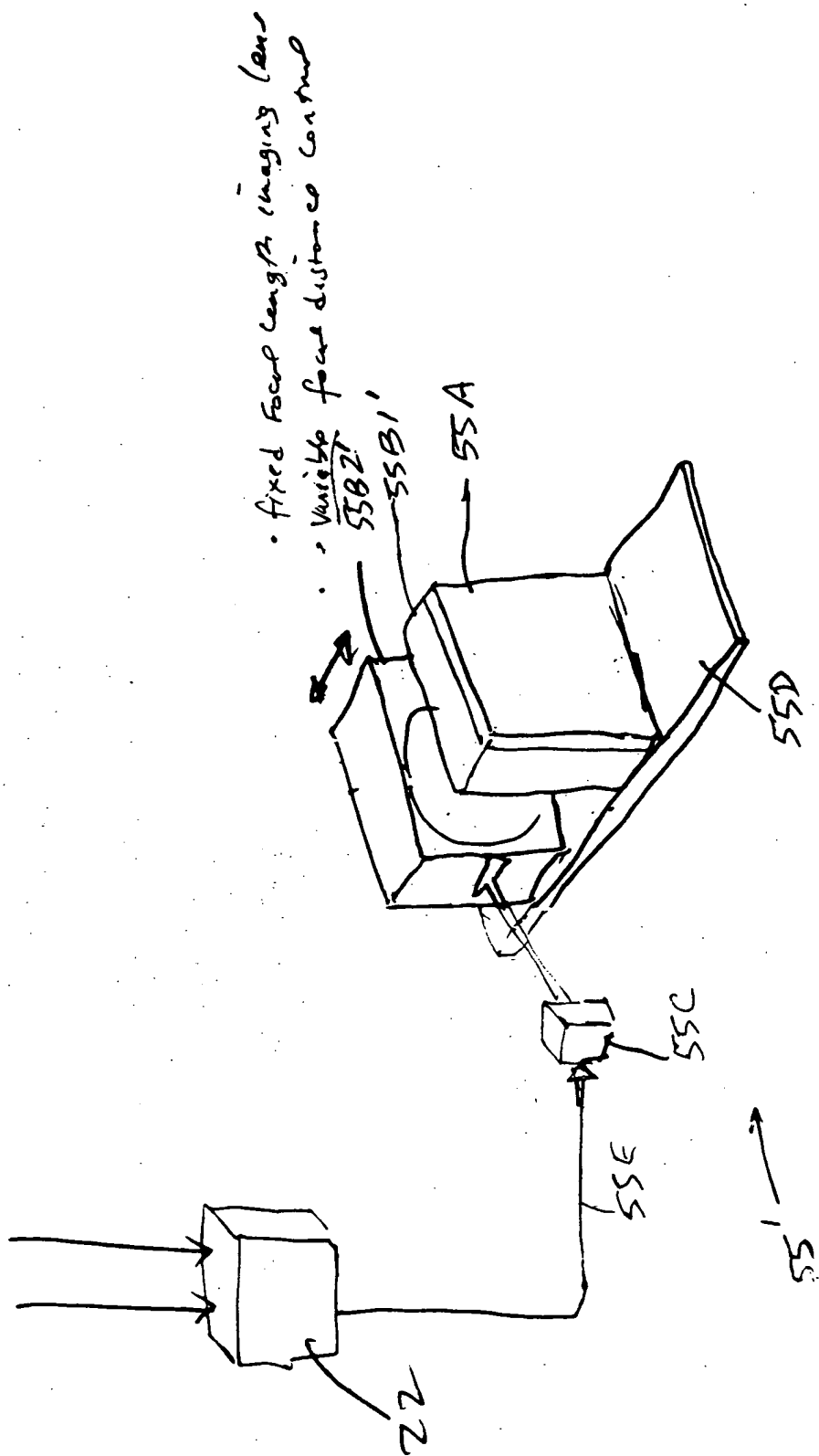


FIG. 5B4

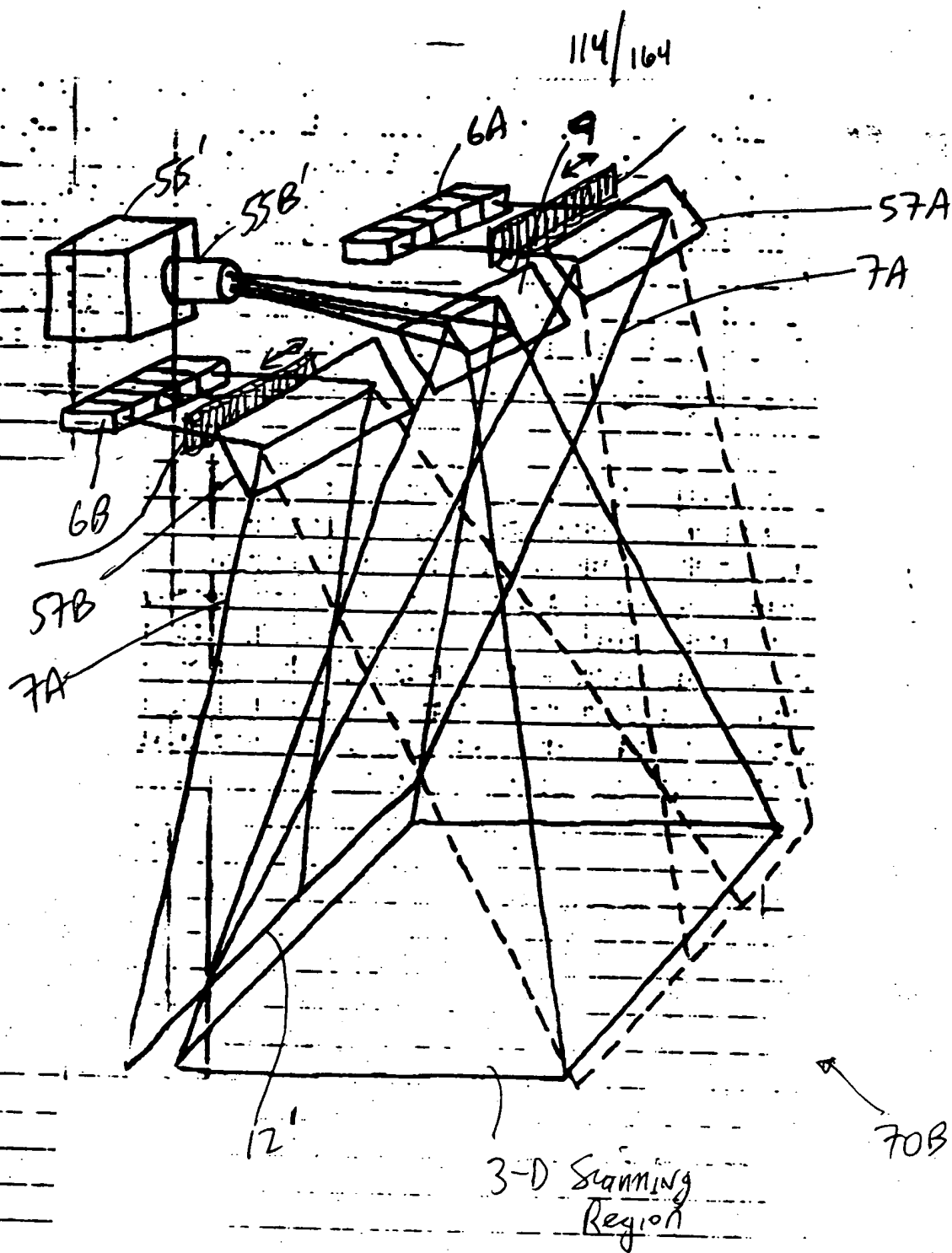


FIG. 5C1

- (1) Variable focal length camera lens
(2) Fixed focal distance

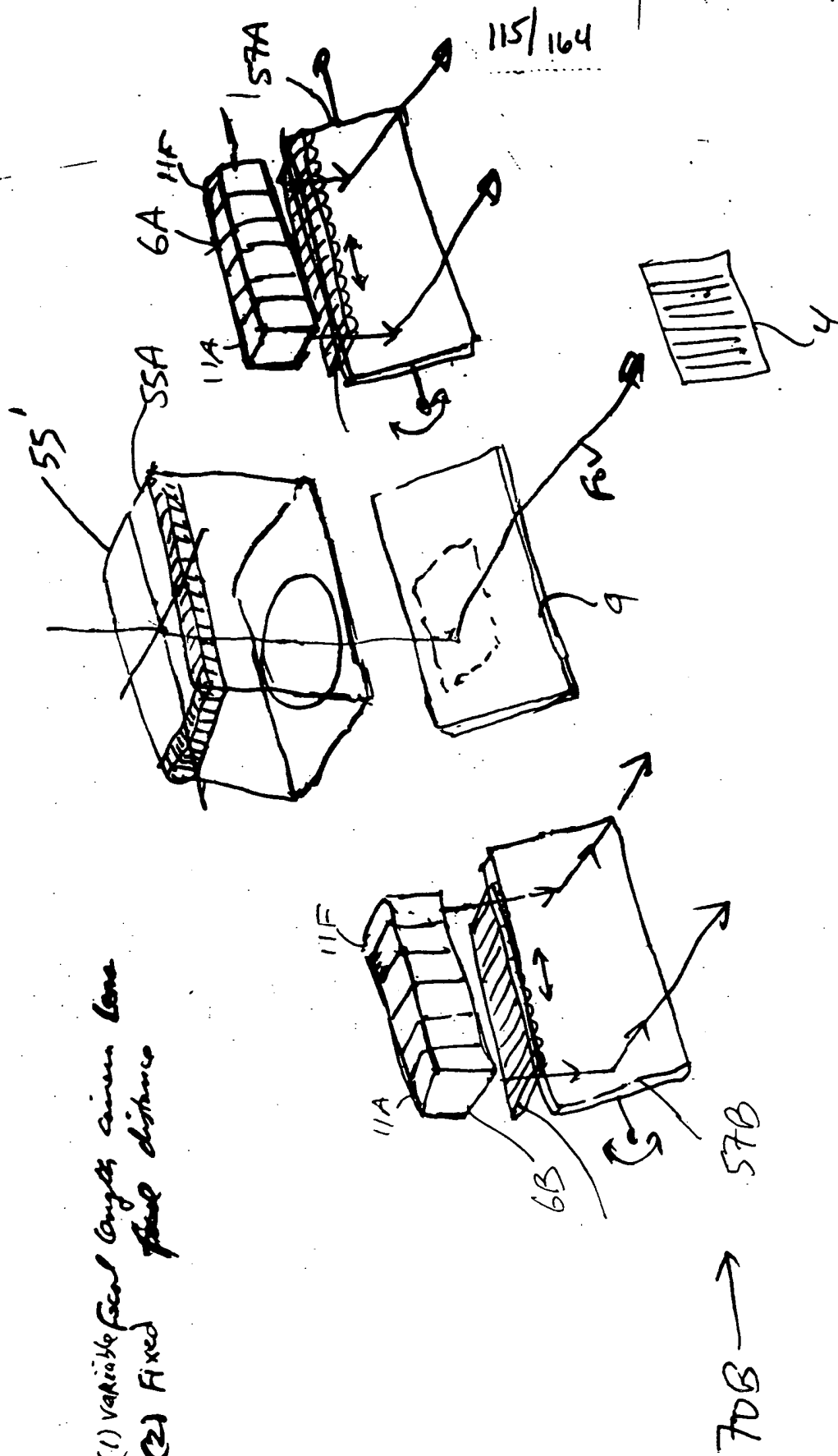
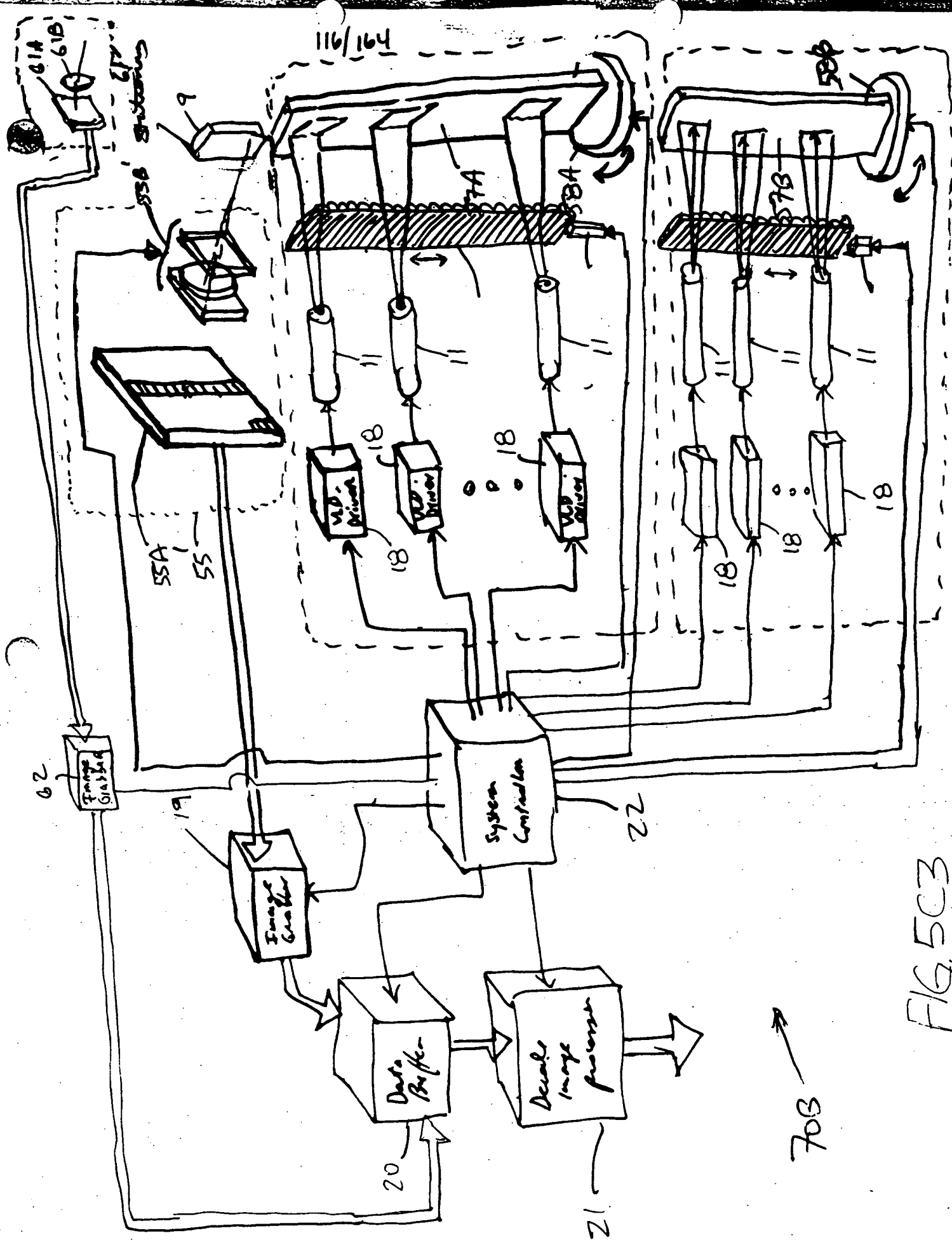


FIG. 502



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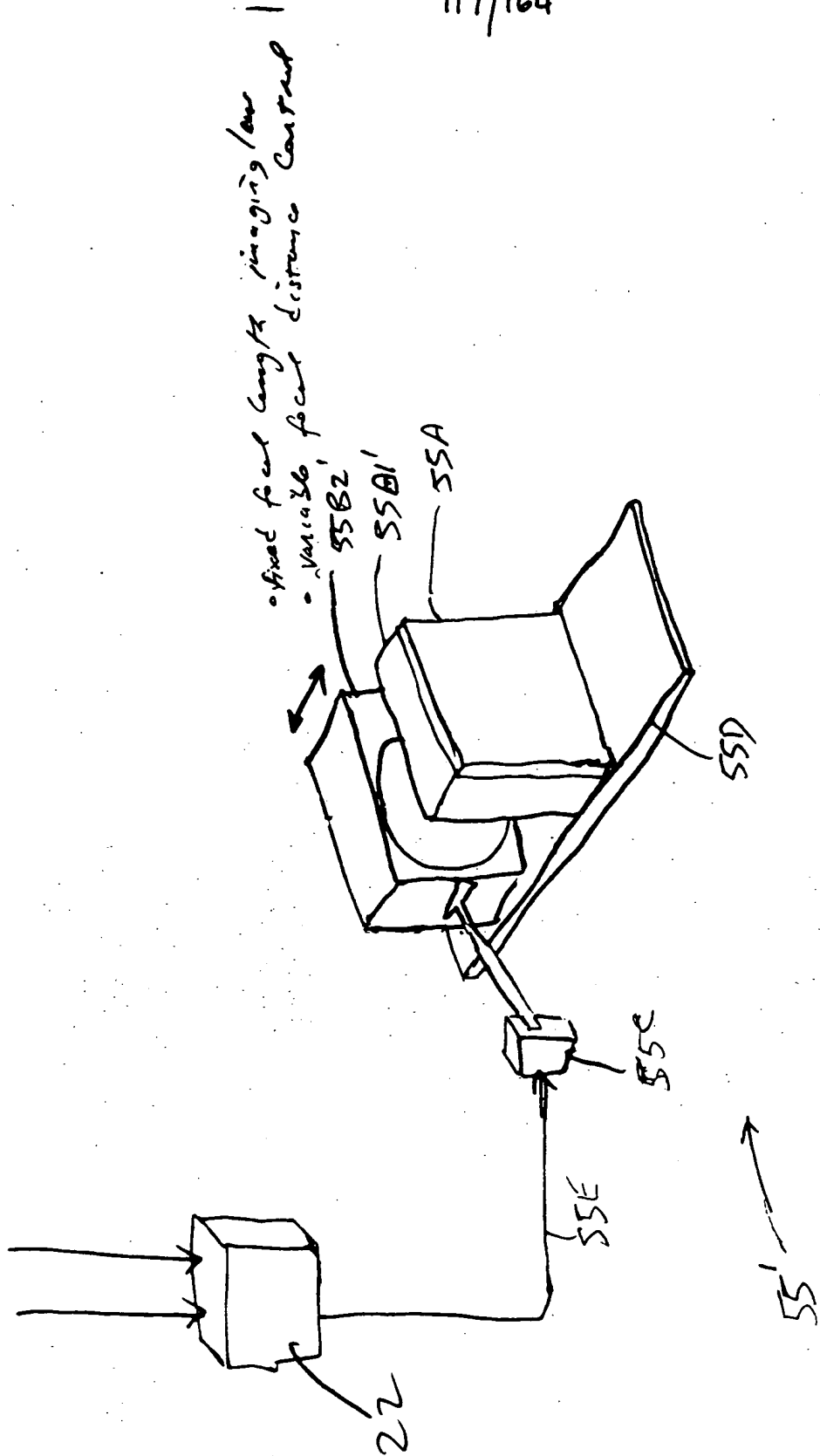


FIG. 5C4

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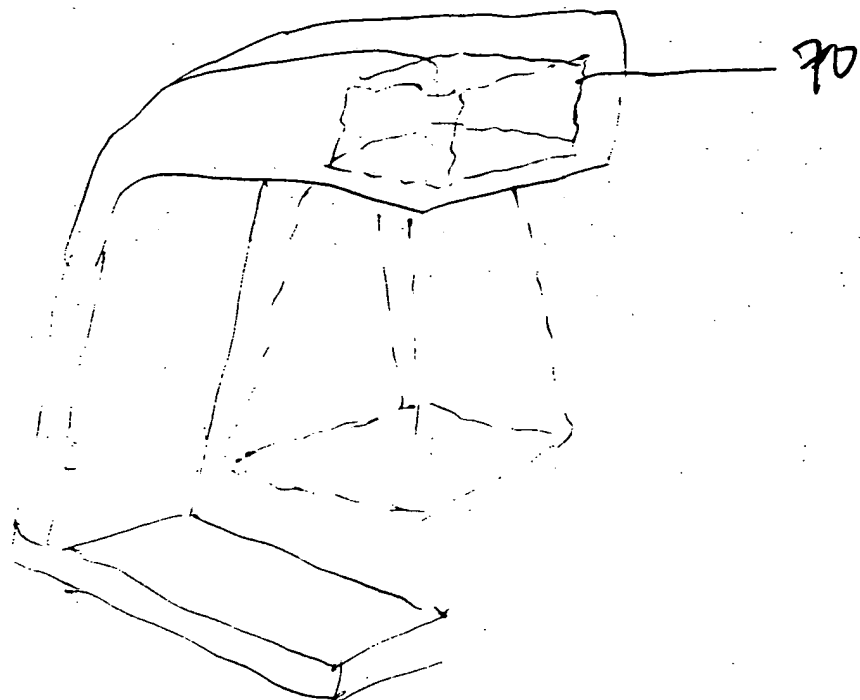


FIG. 5D

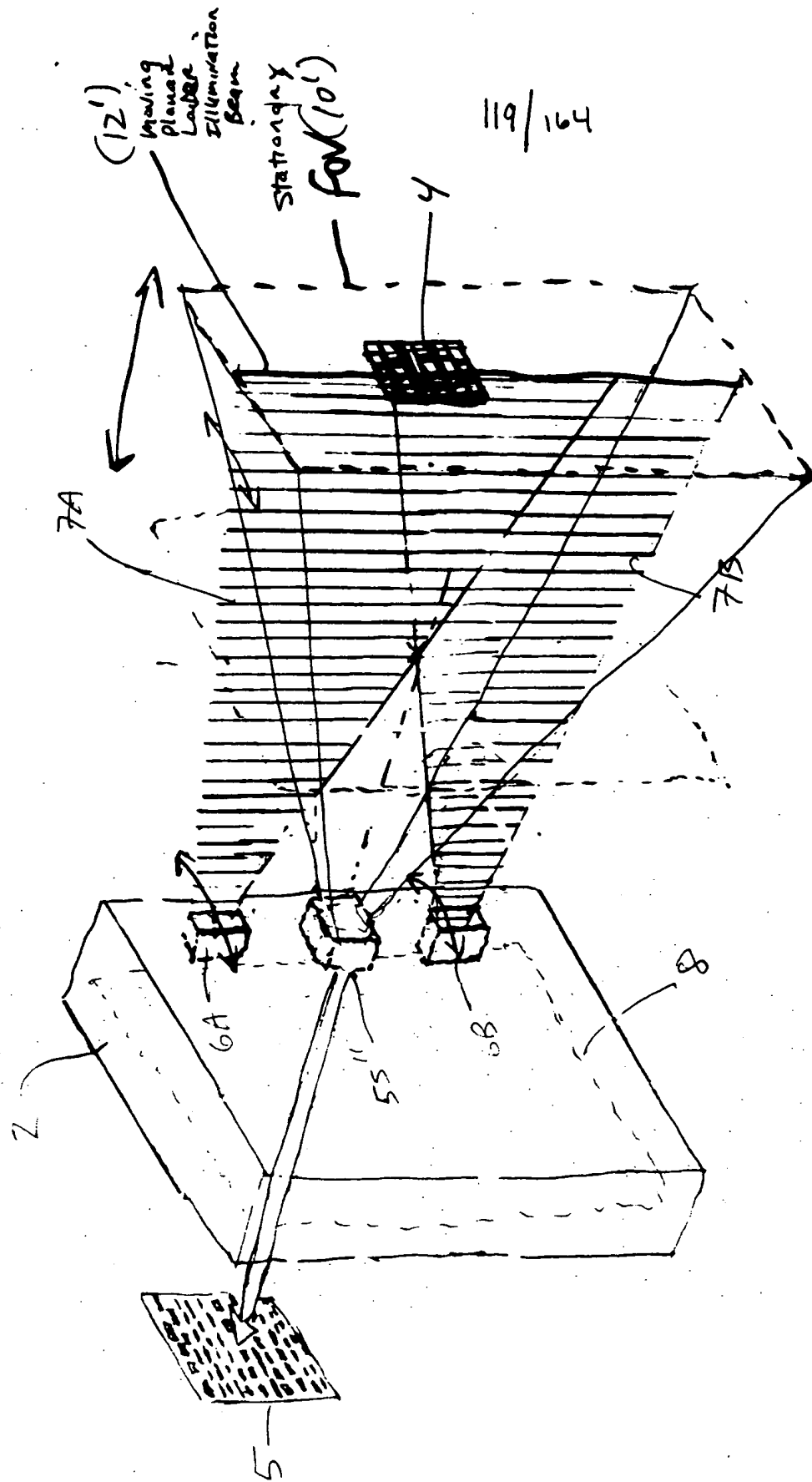


FIG. 6A

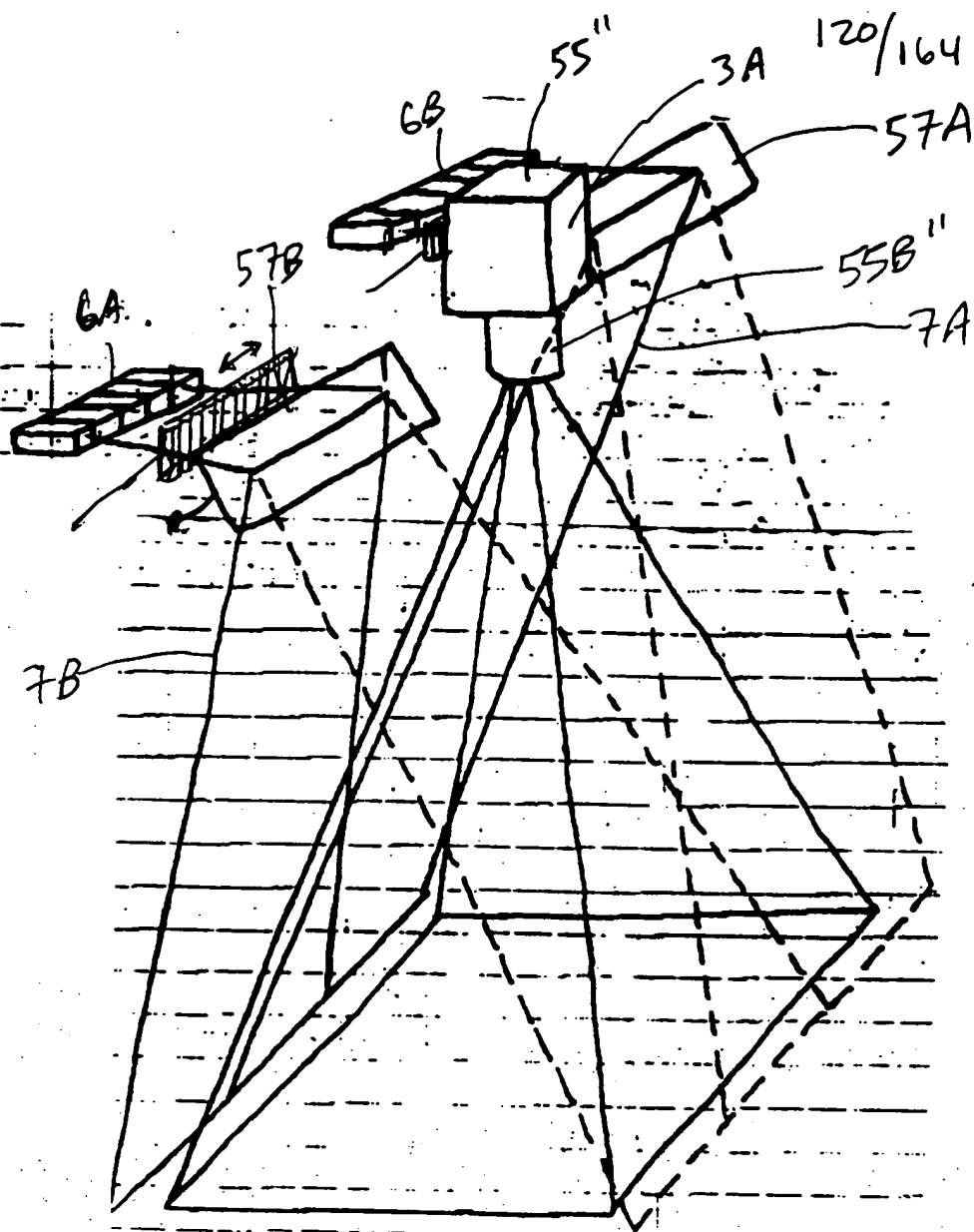
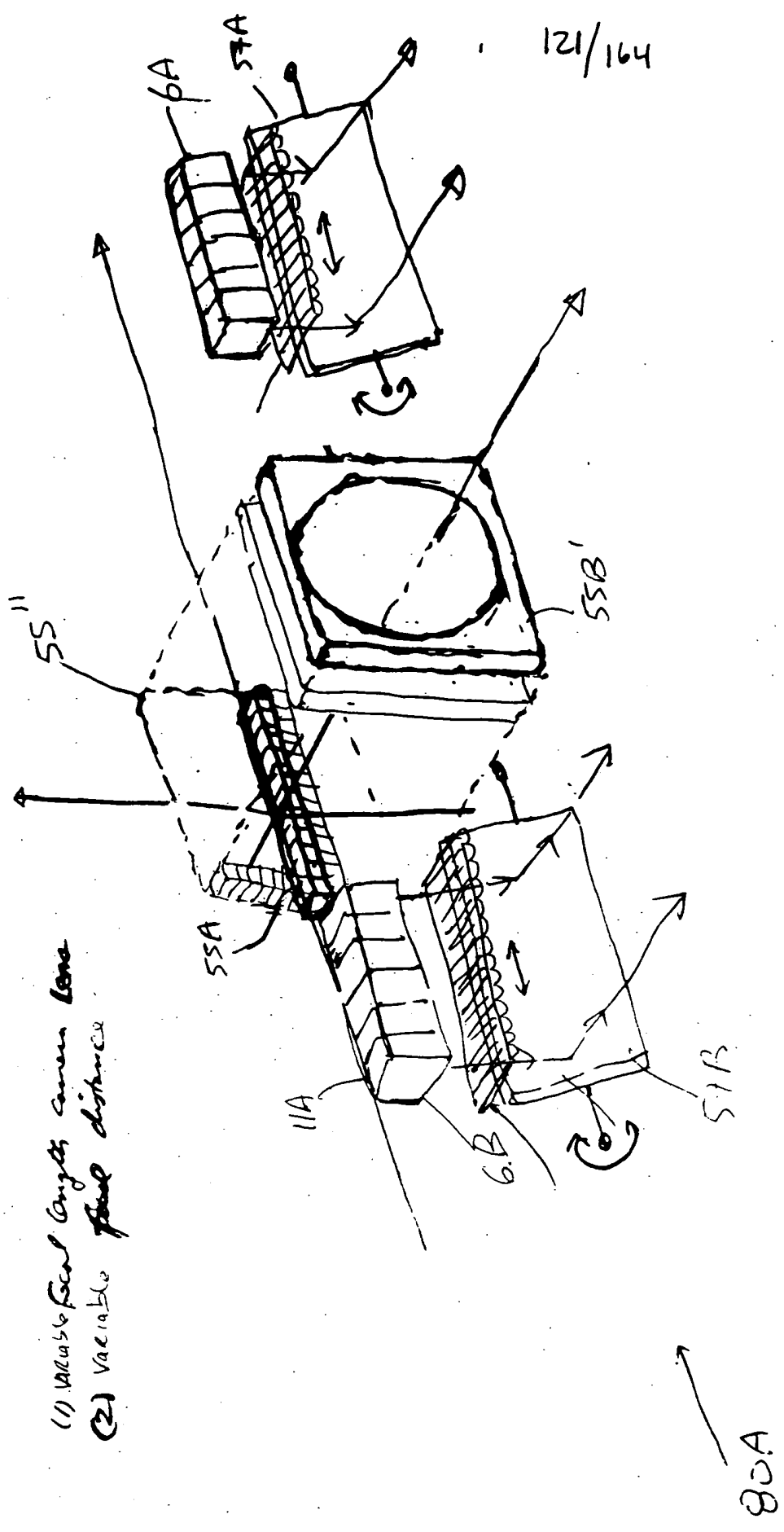


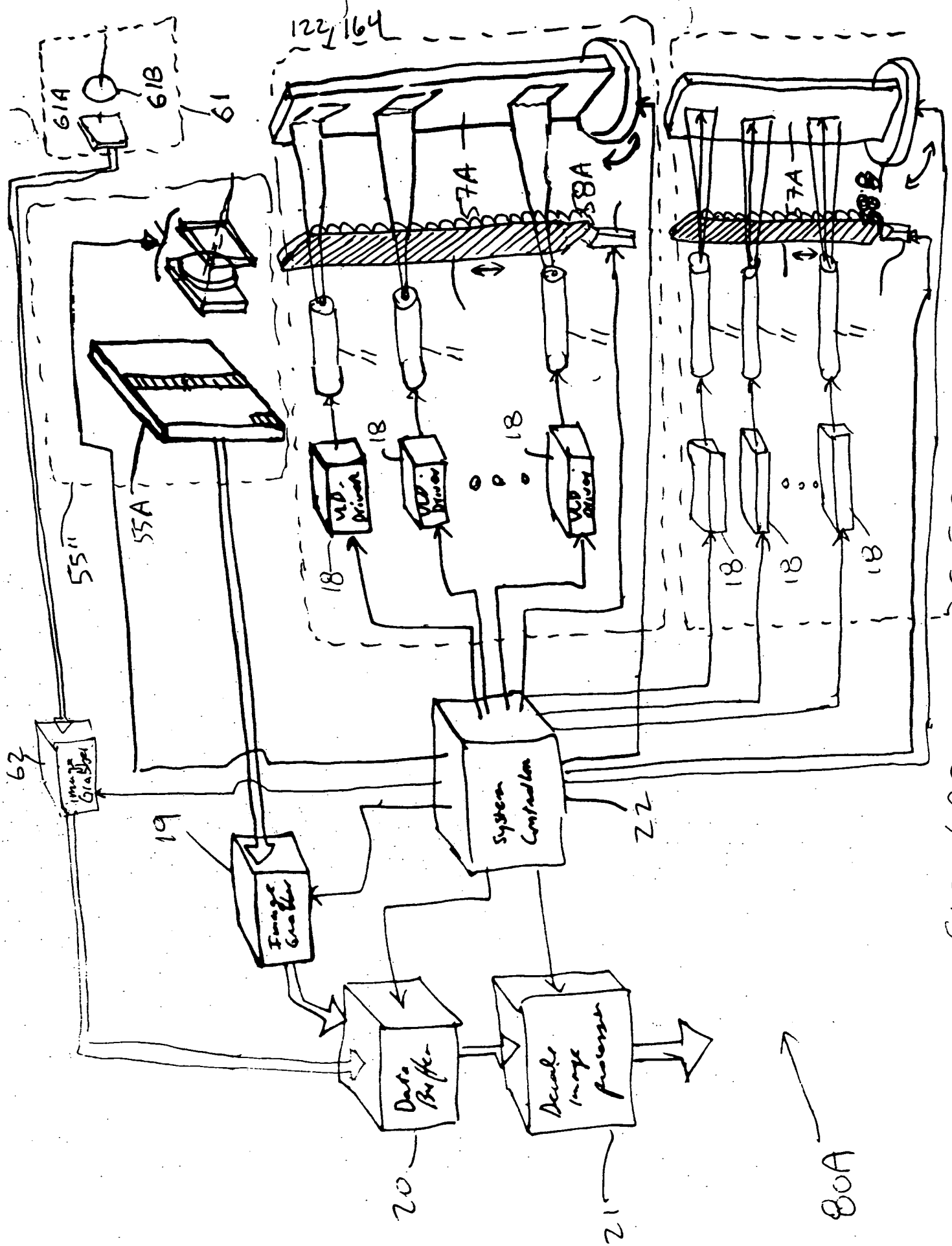
FIG. 6B1



- (1) Variable focal length camera lens
- (2) Variable focal distance

FIG. 6B2

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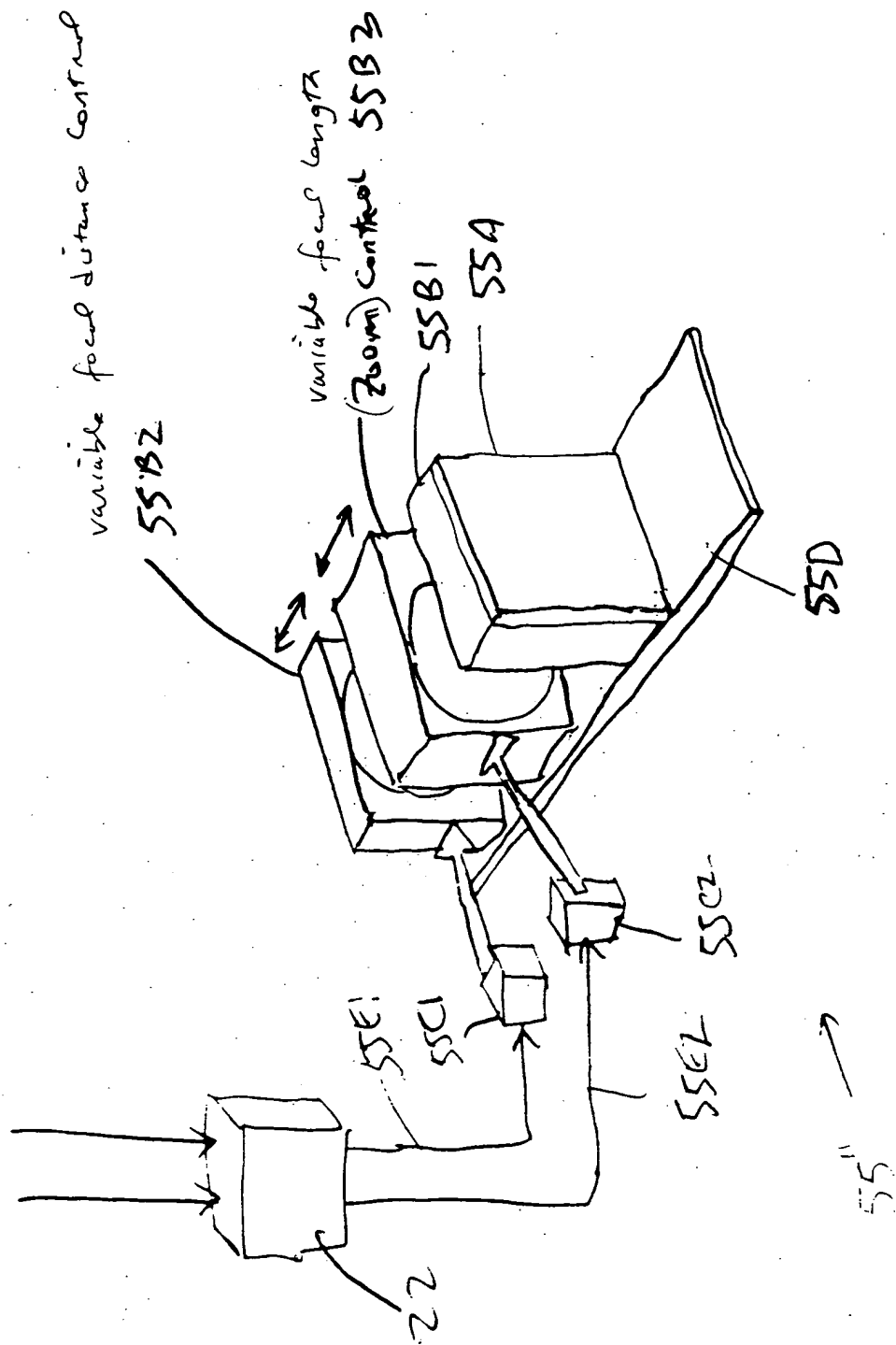


FIG. 6B4

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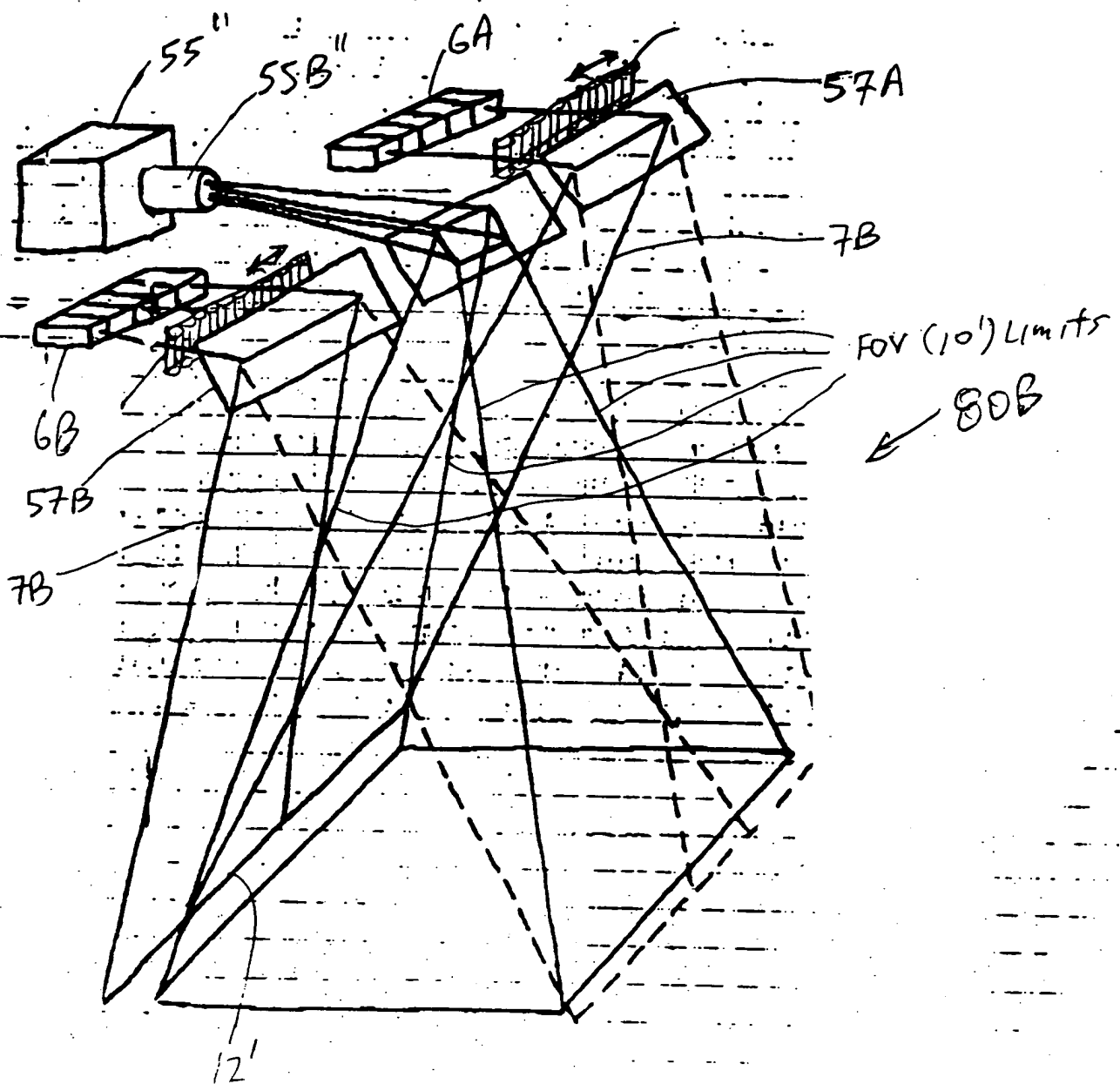
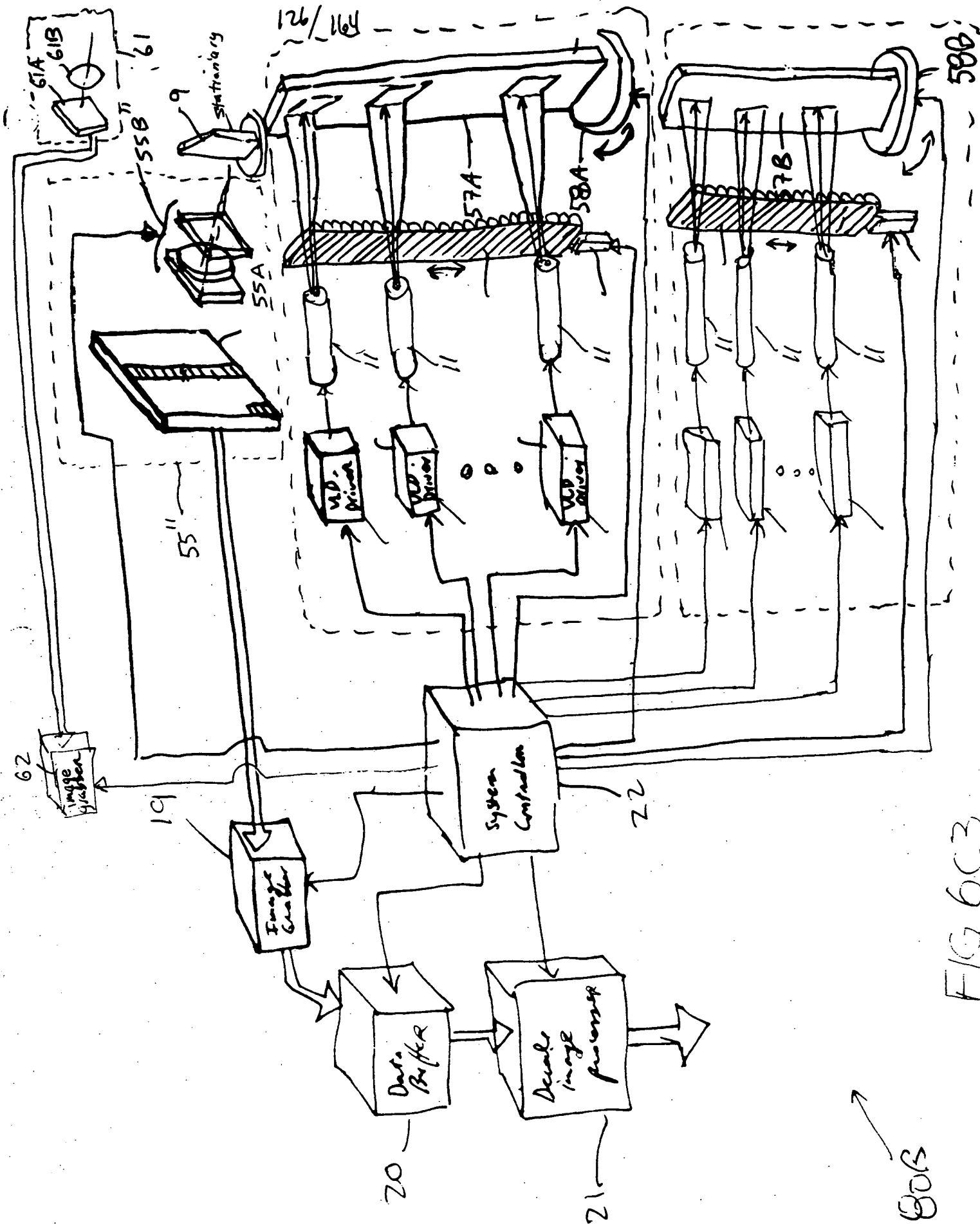


FIG. 6C1

[illegible]

FIG. 6C2



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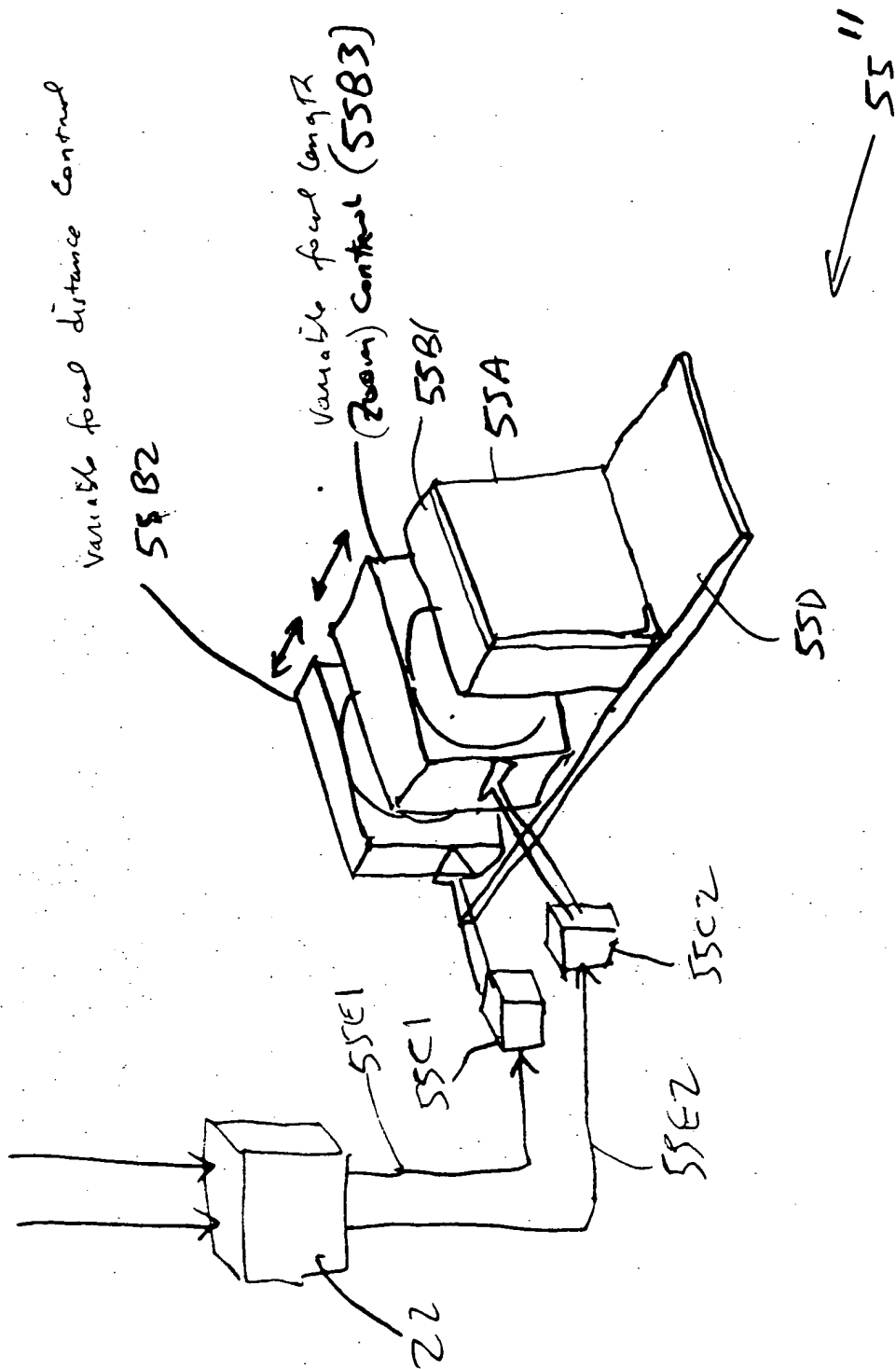


FIG. 6C4

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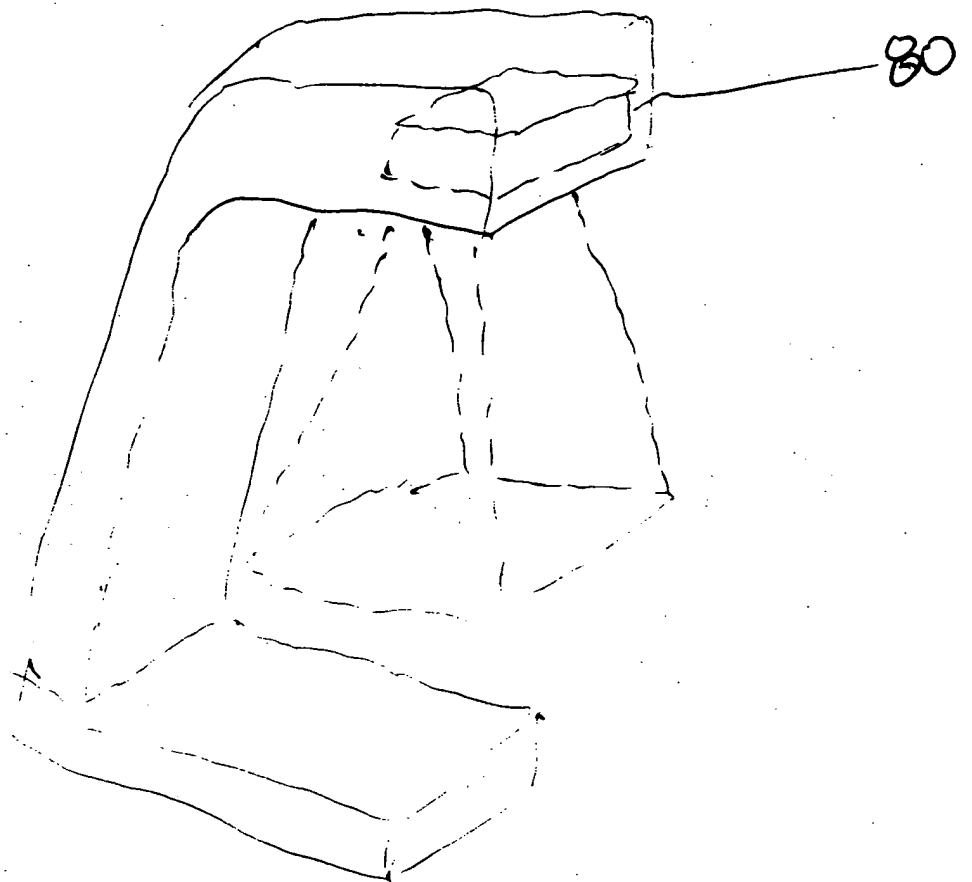


FIG. 6D

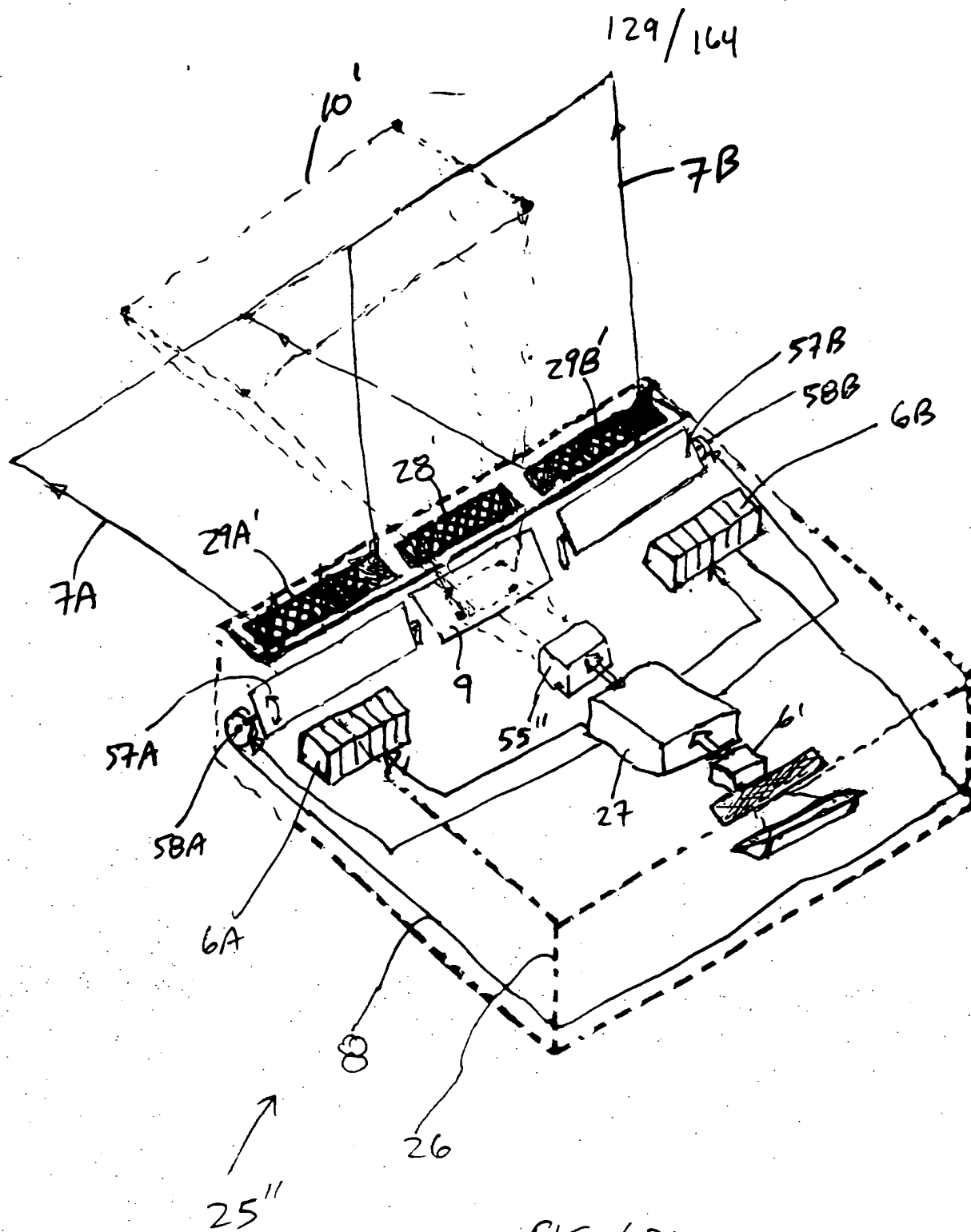


FIG. 6D1

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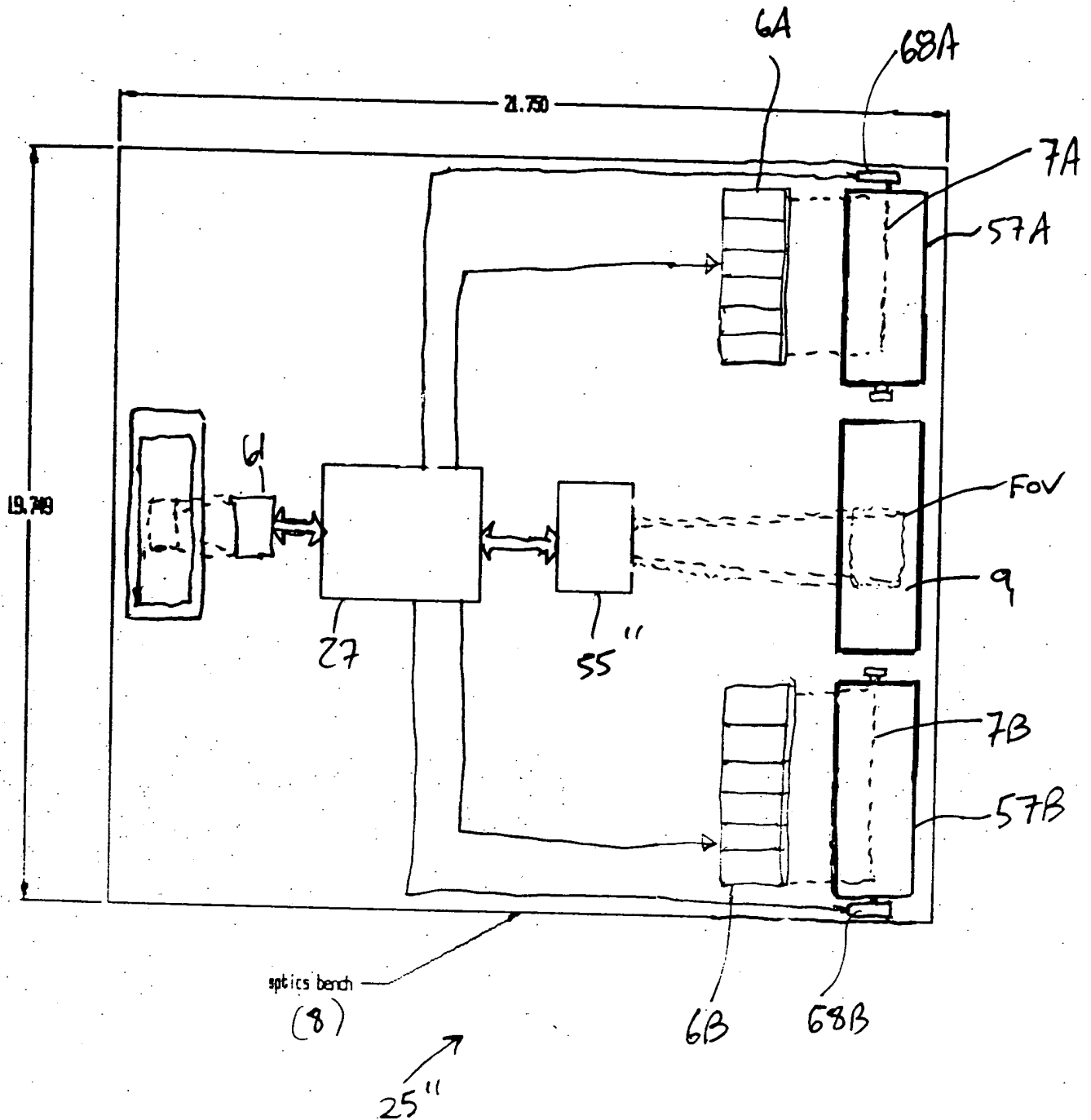
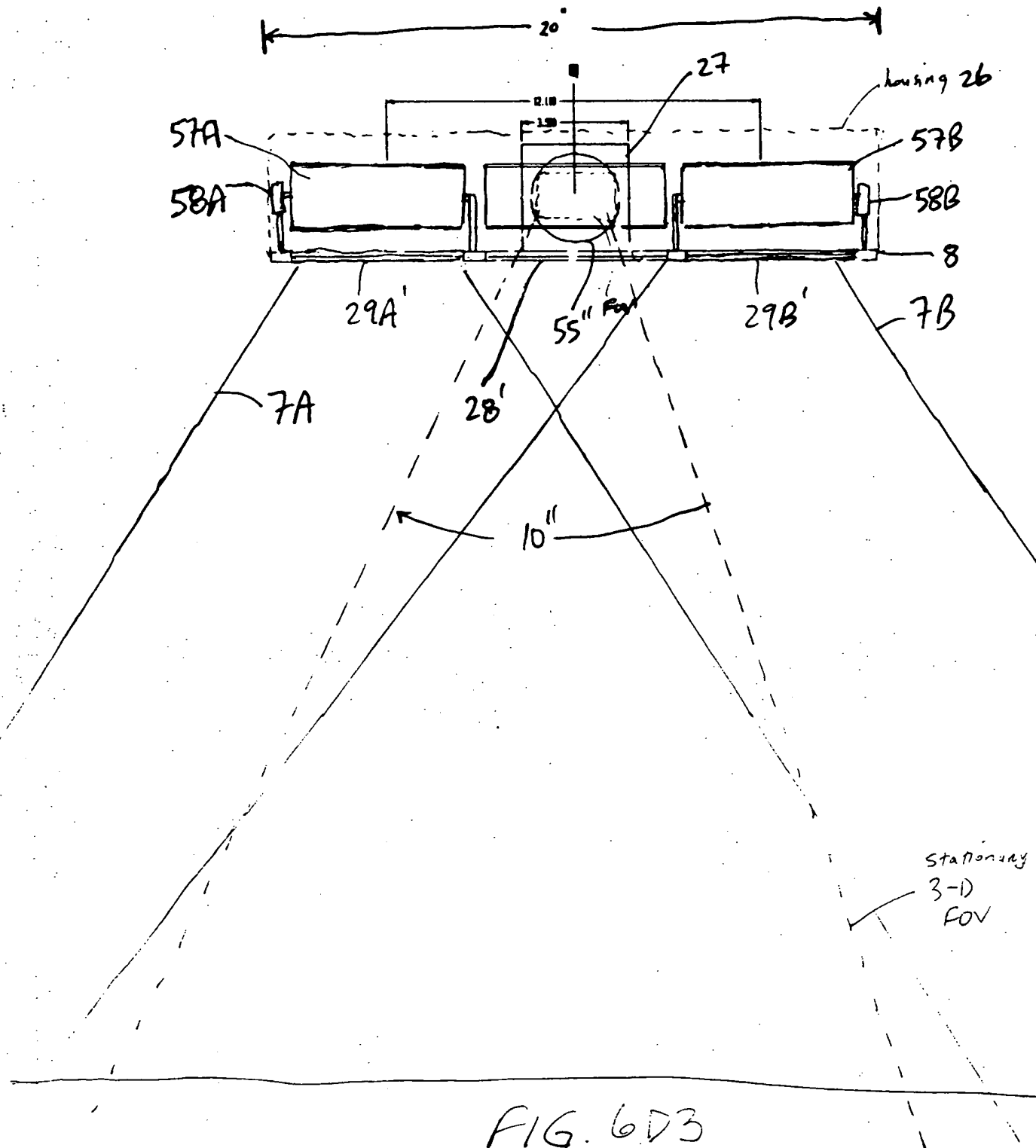


FIG. 6DZ

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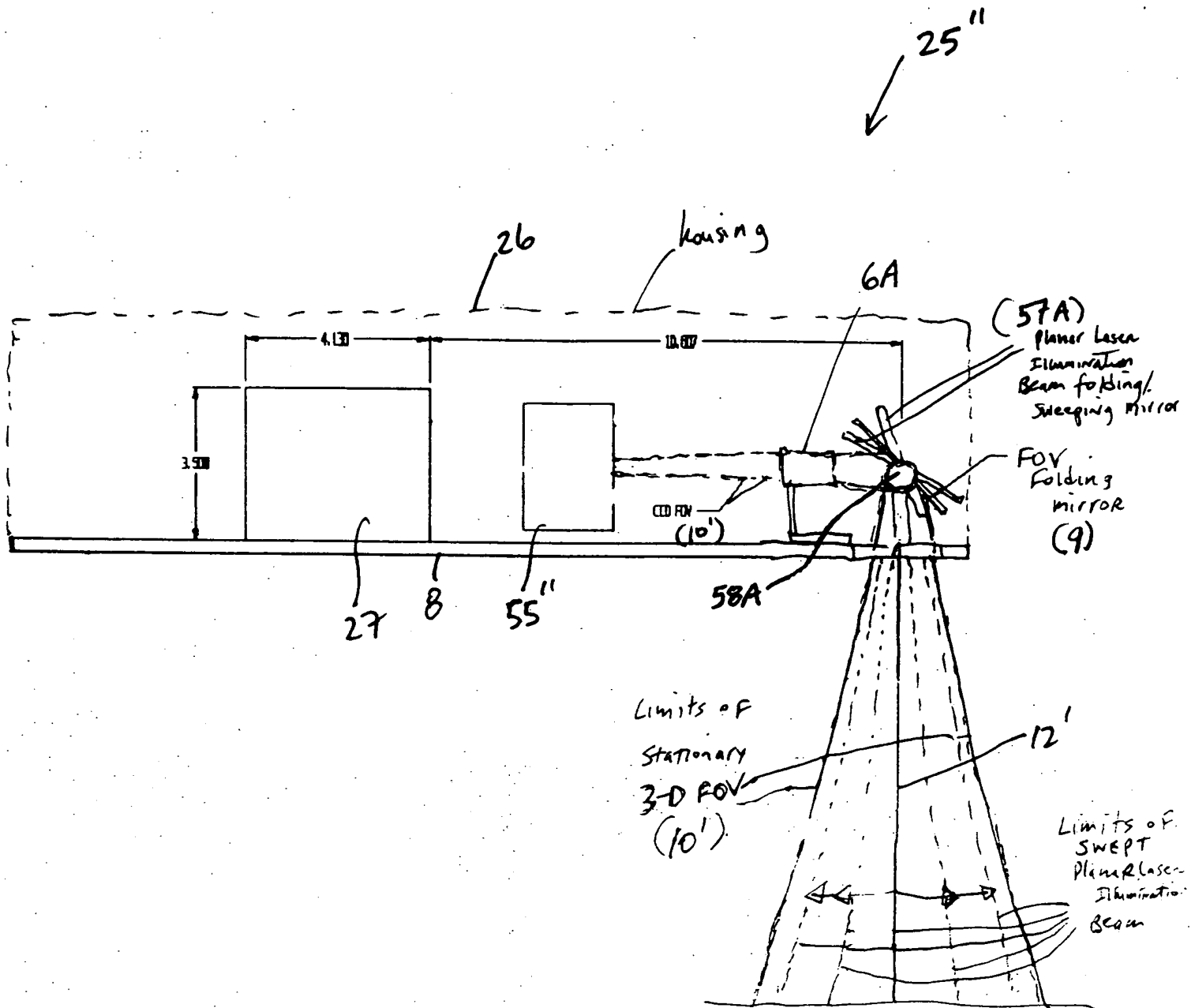


FIG. 6D4

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variable FOV

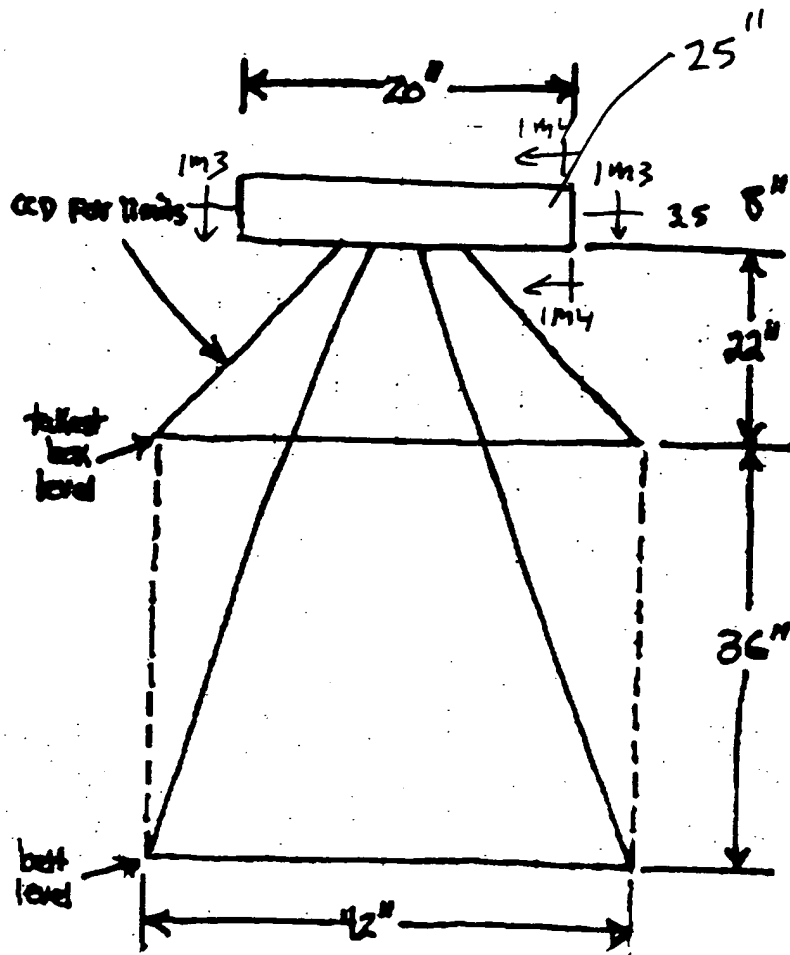


FIG. 6D5

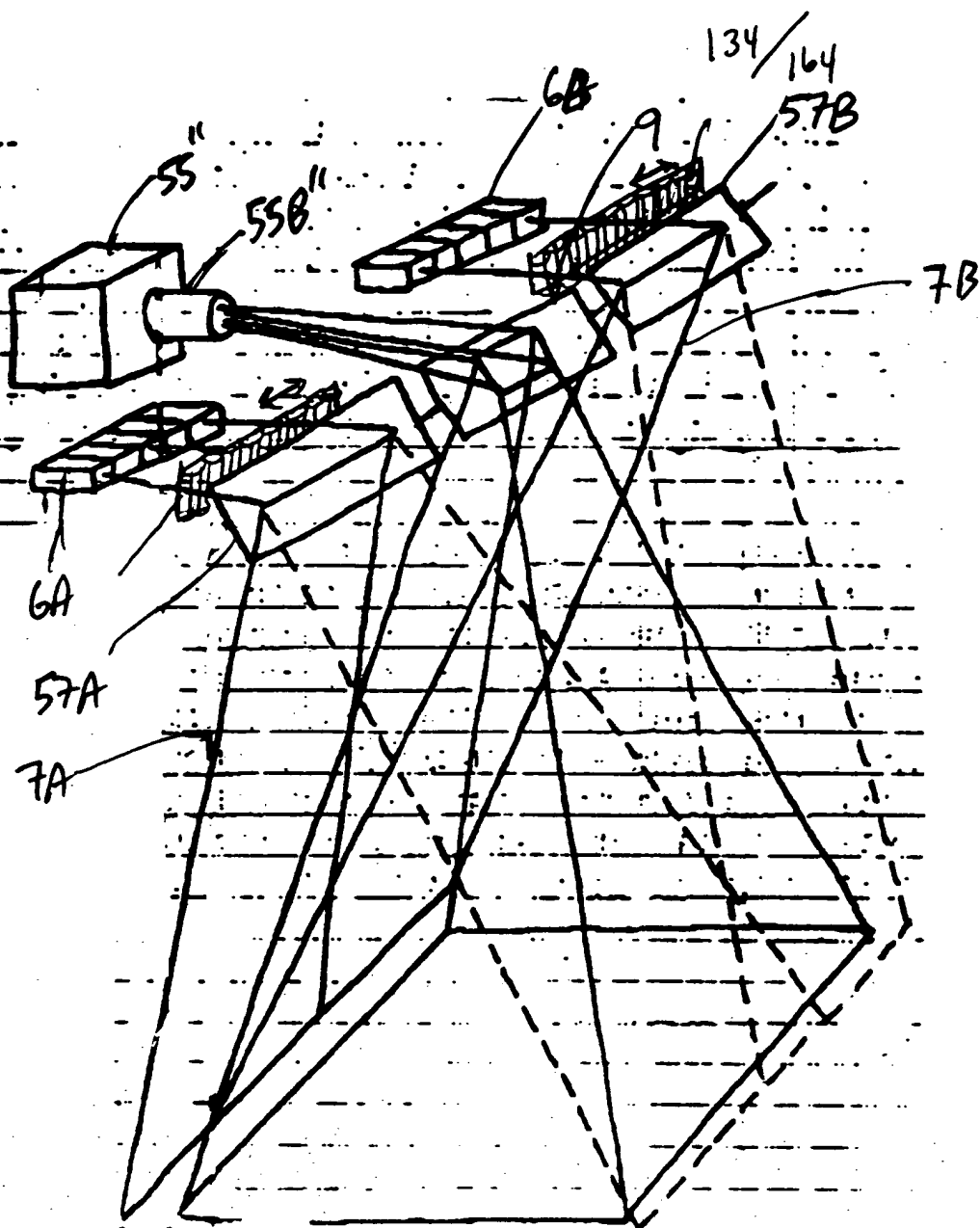
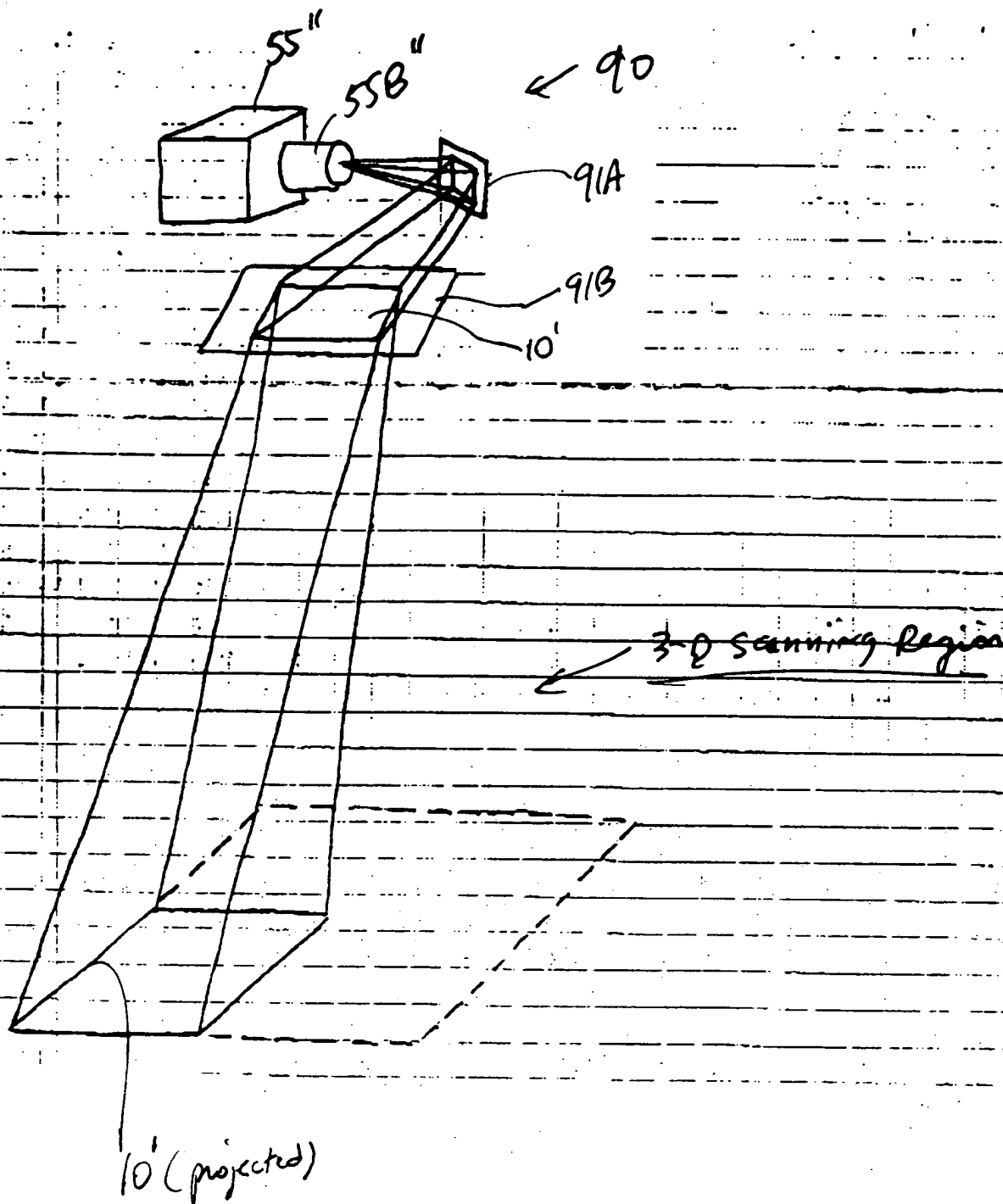


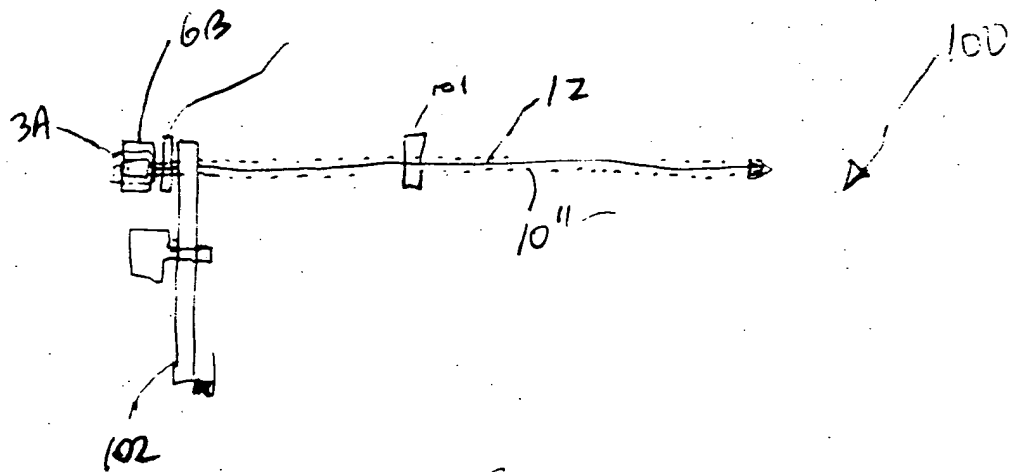
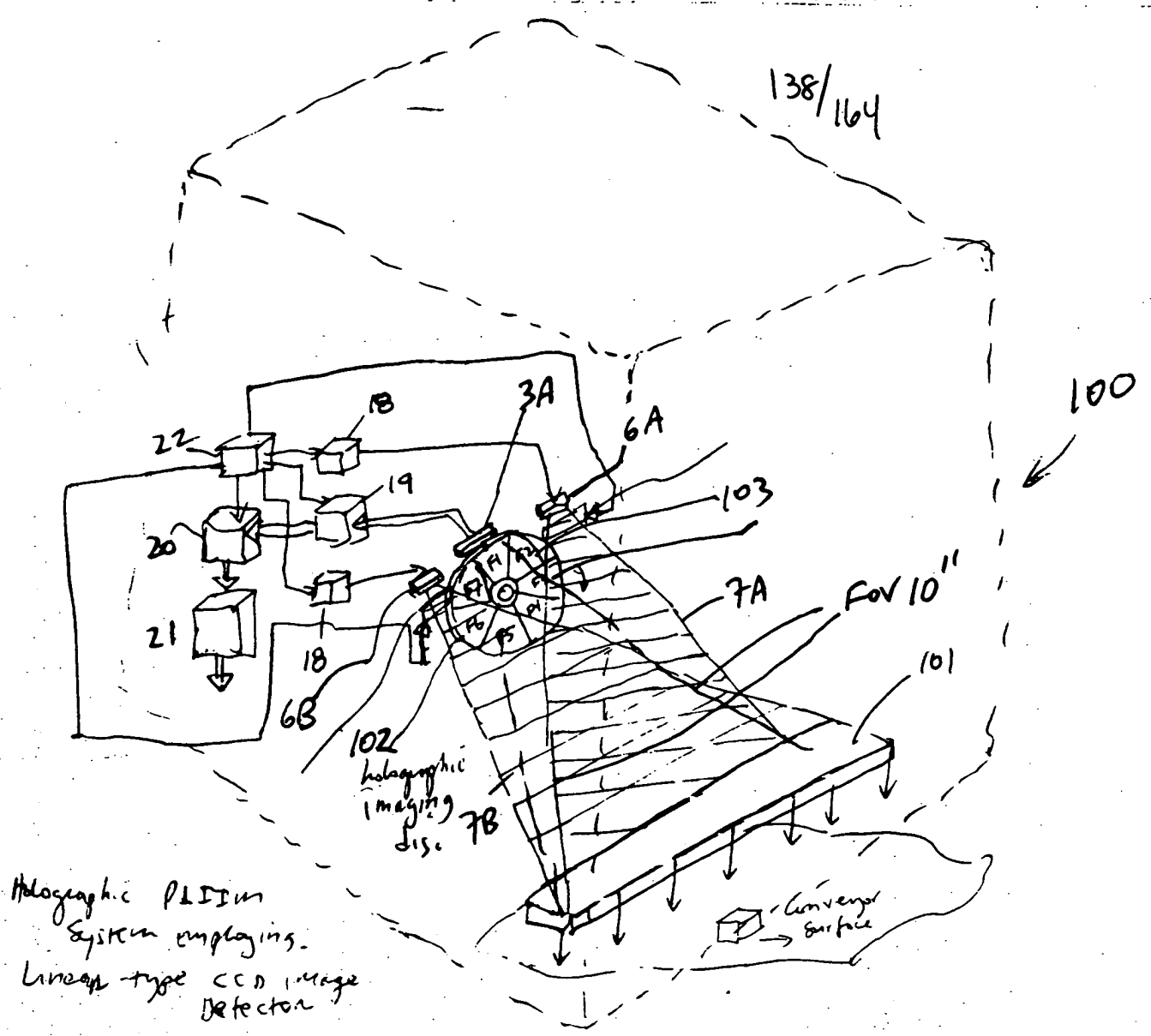
FIG. 6E1

FIG. 6E2

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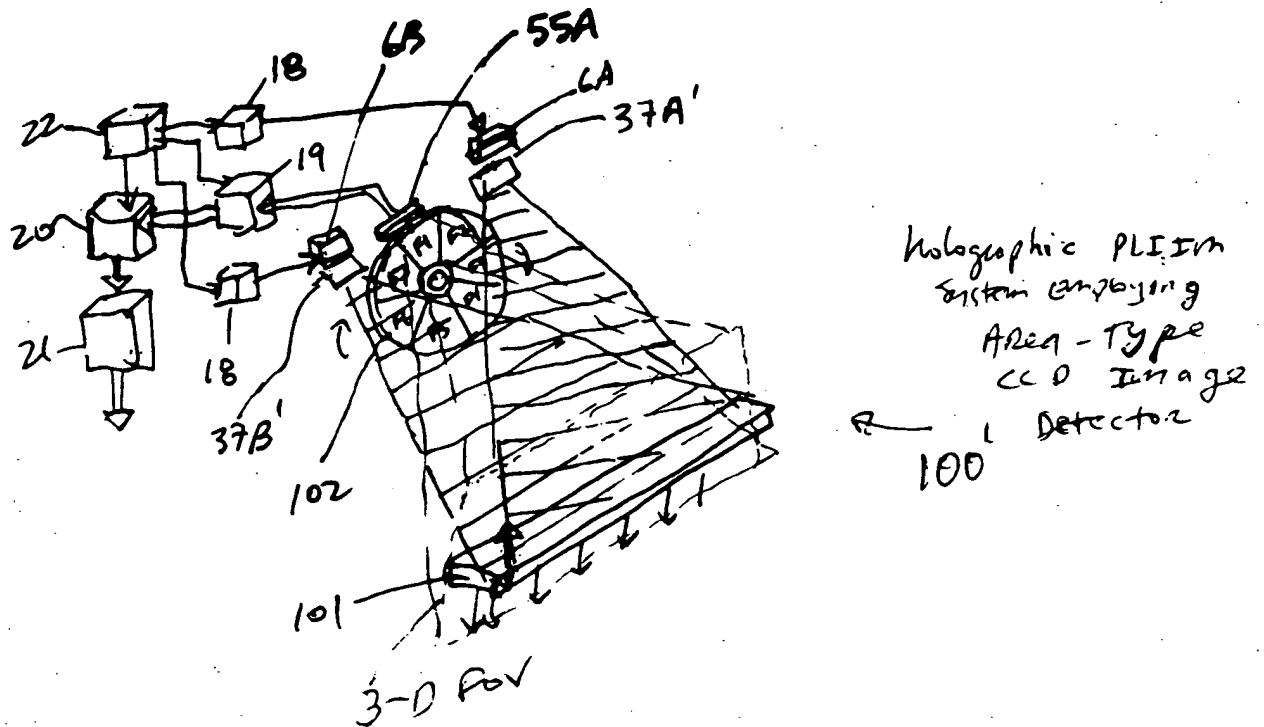


FIG. 8A

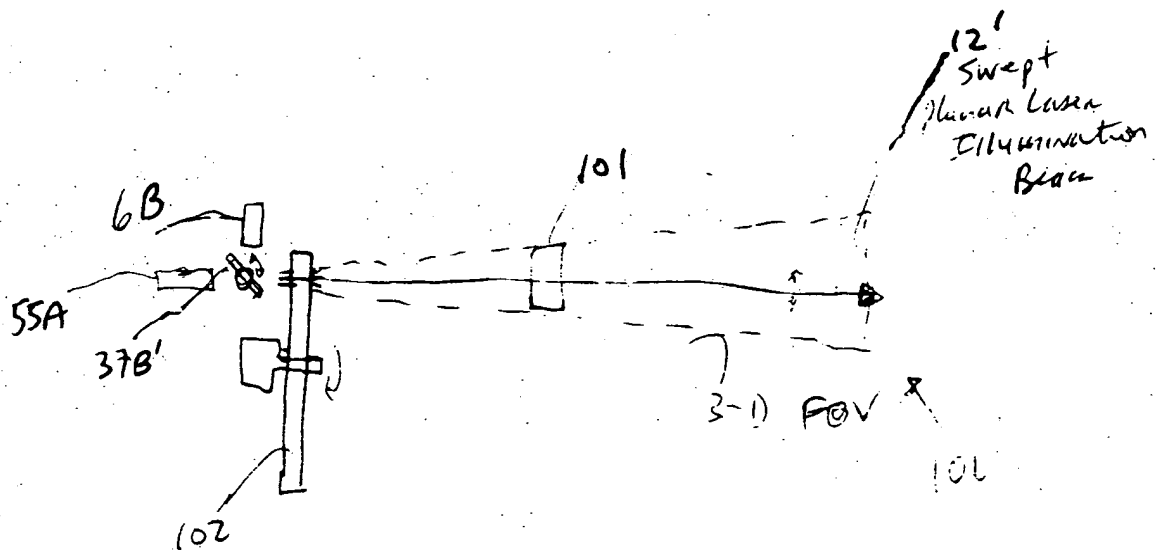


FIG. 8B

R_{LOCAL} 1-D CCD SCANNER EMBODIMENT

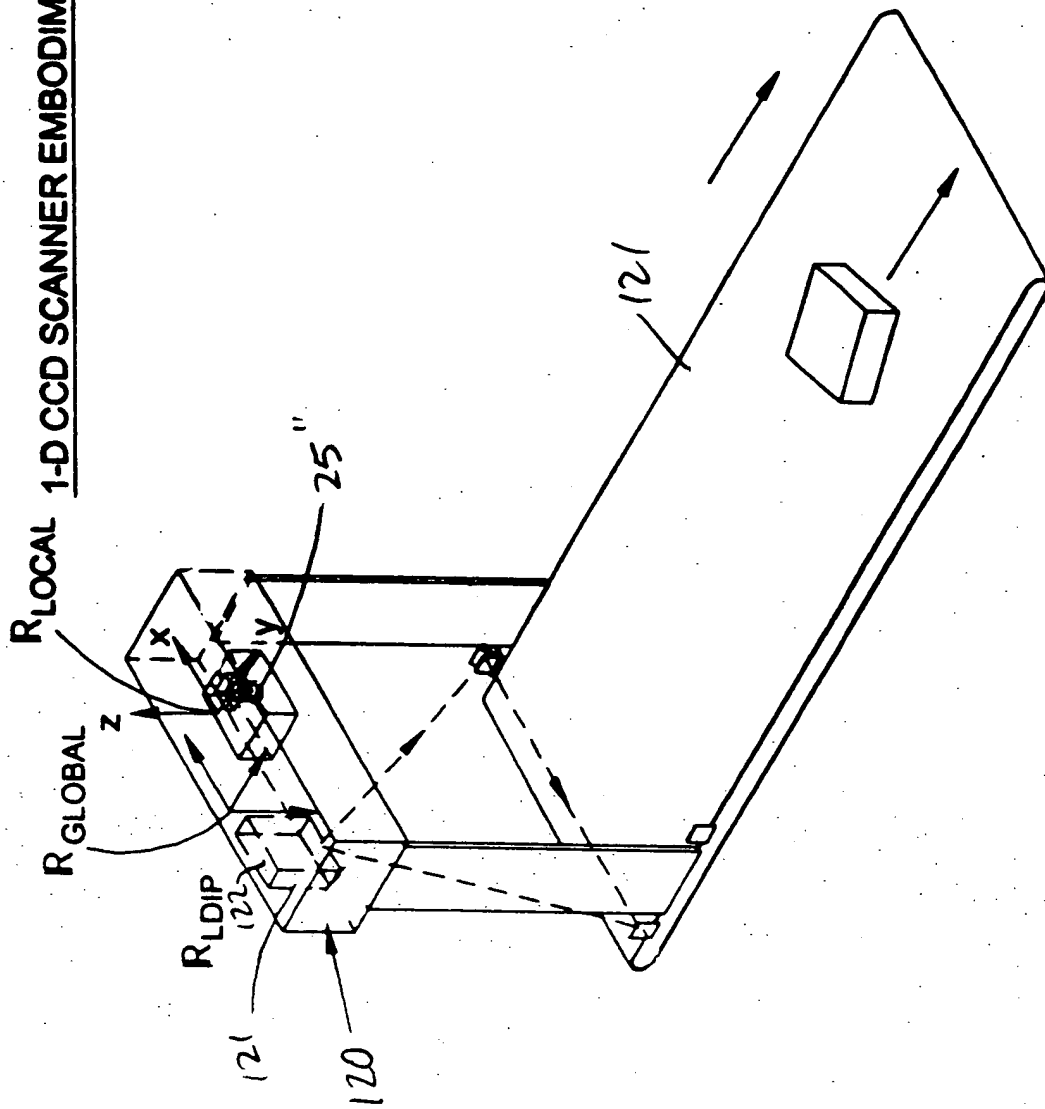


FIG. 9

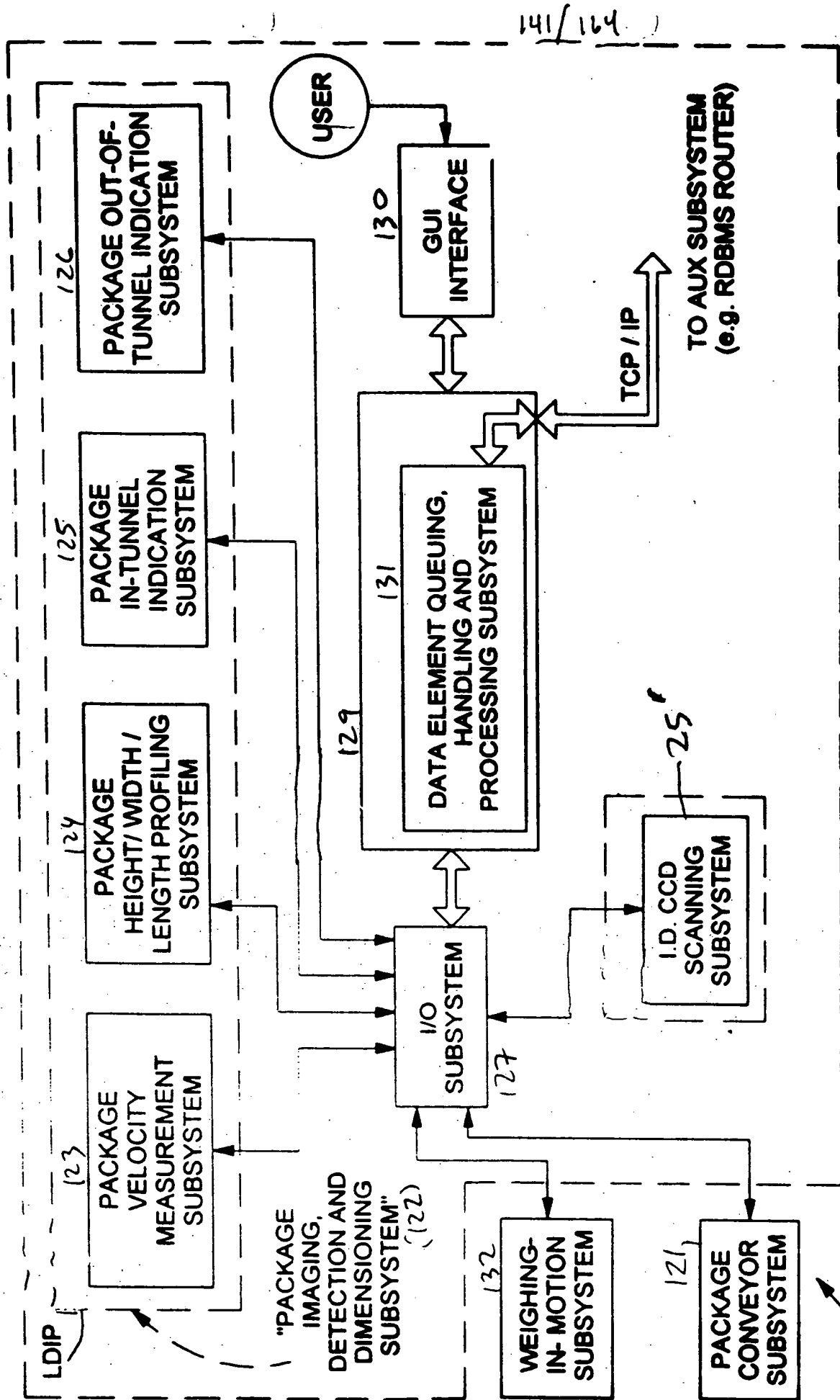


FIG. 10

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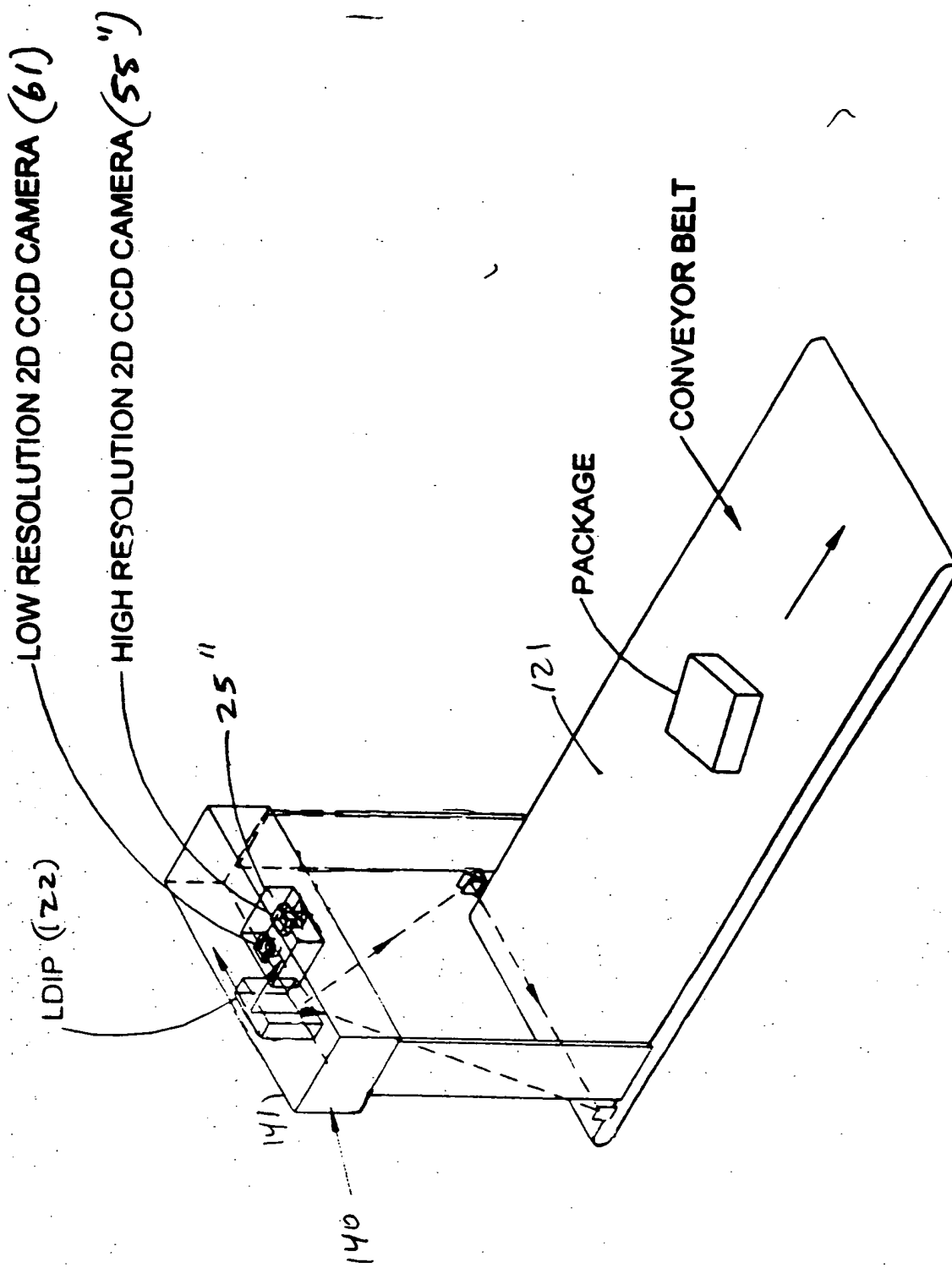


FIG 11

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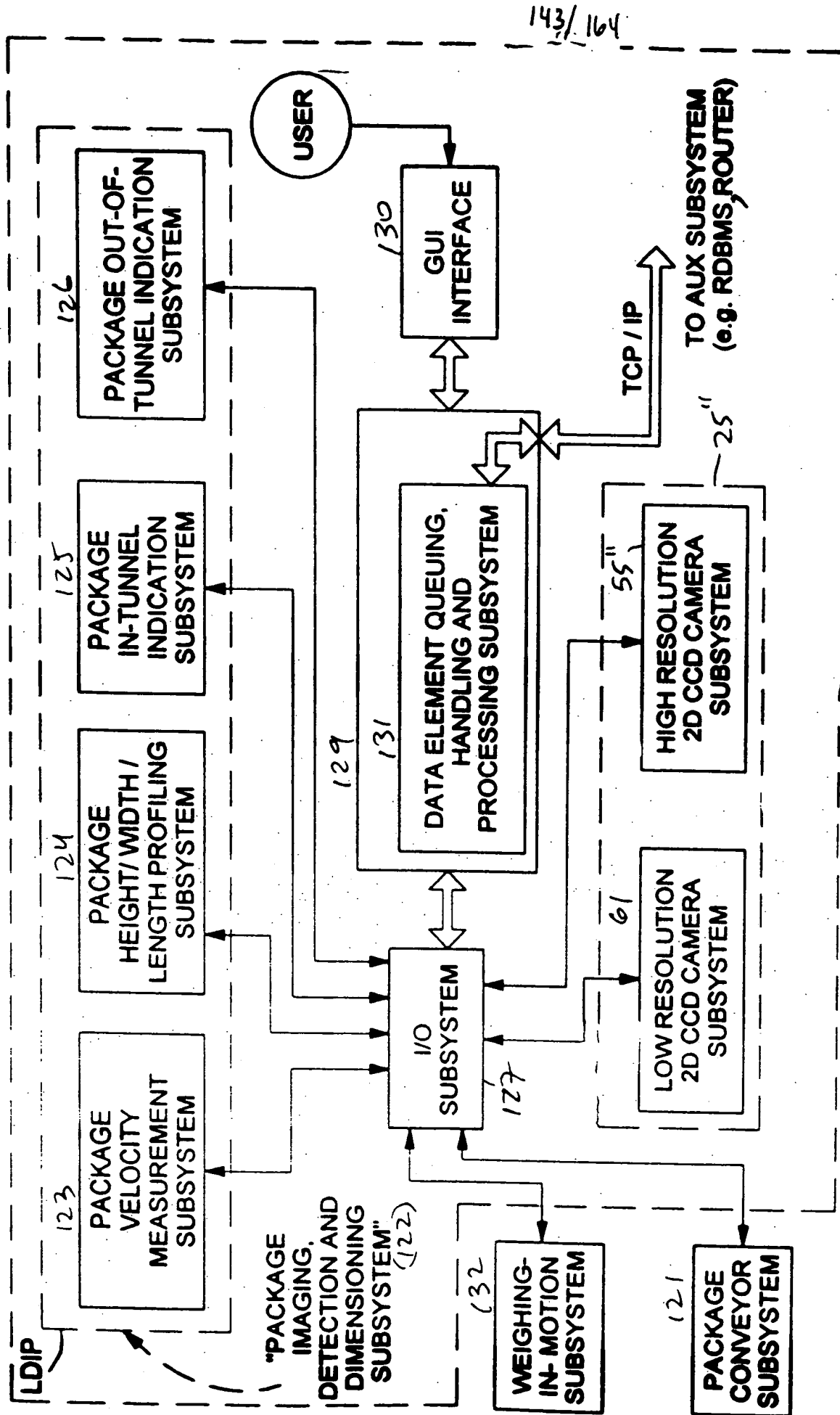


FIG. 12

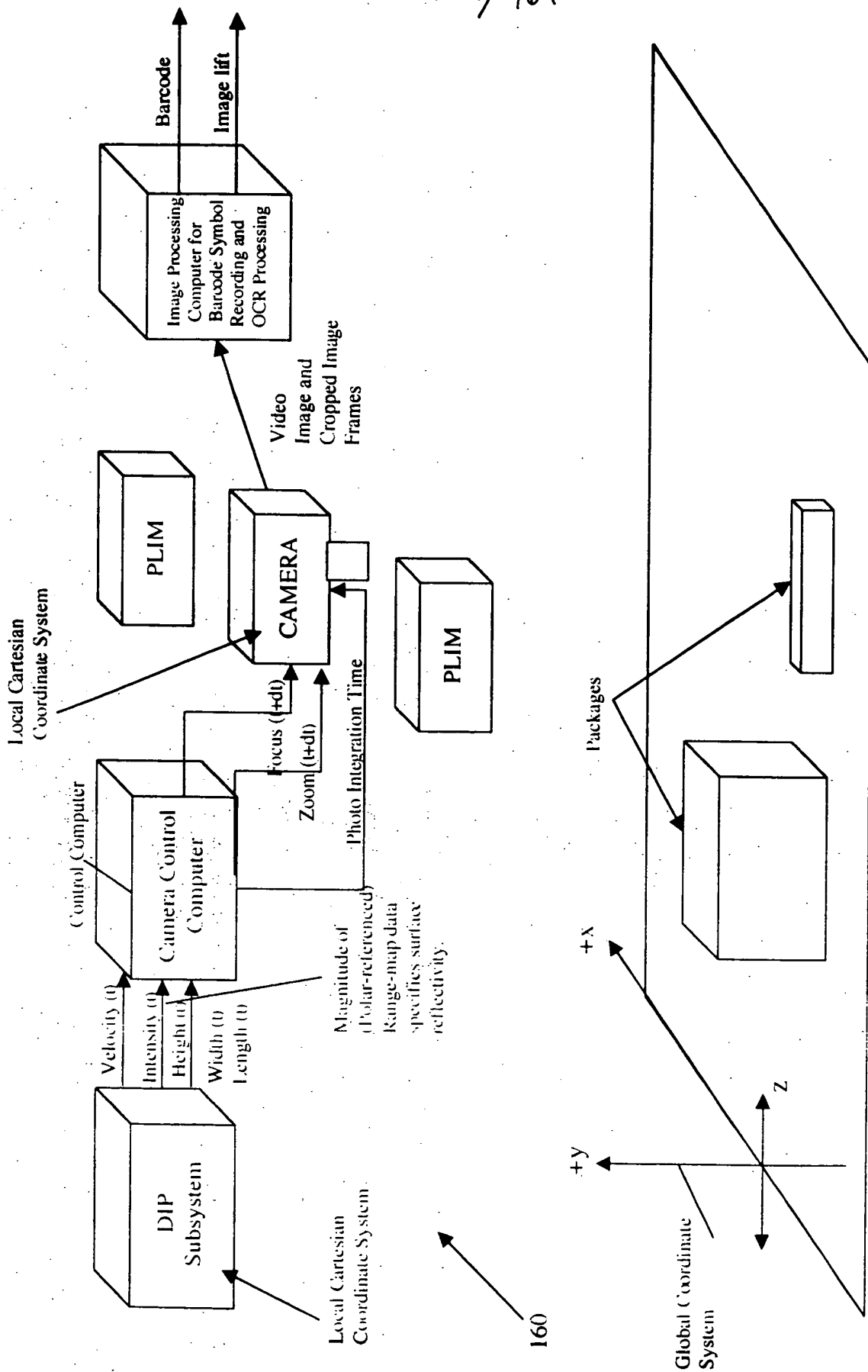
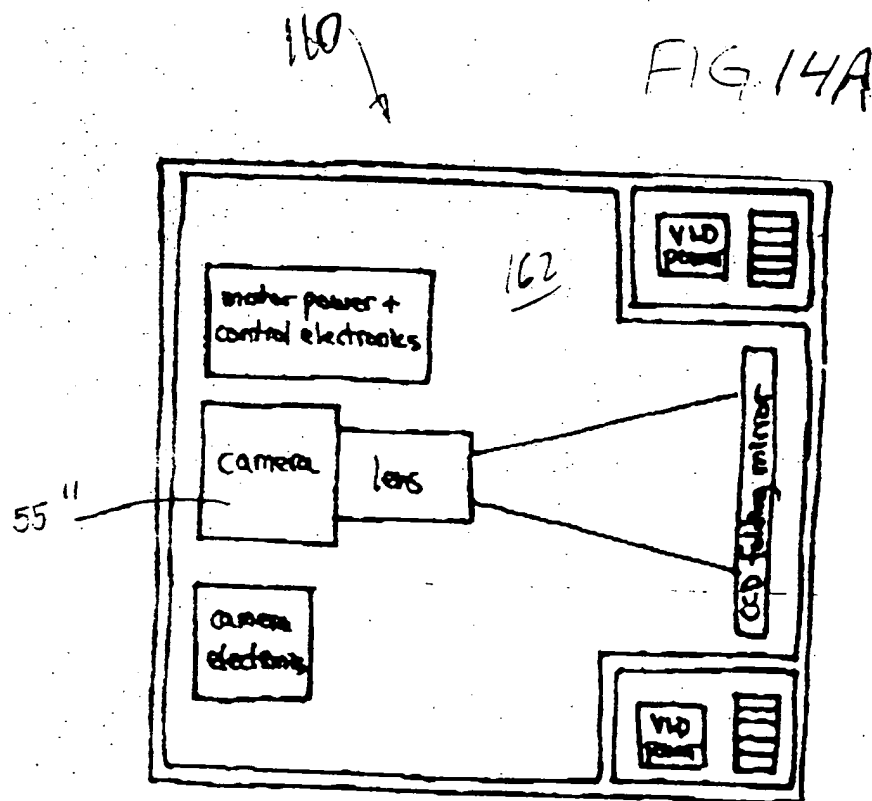
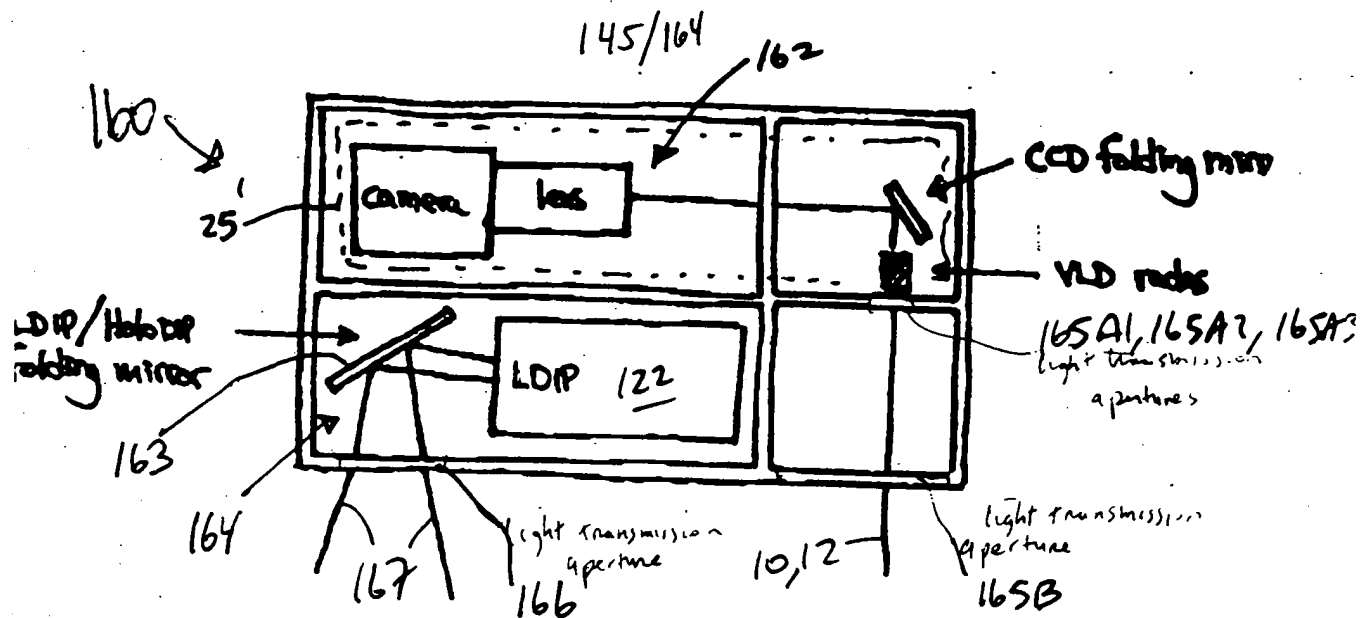


Fig. 13



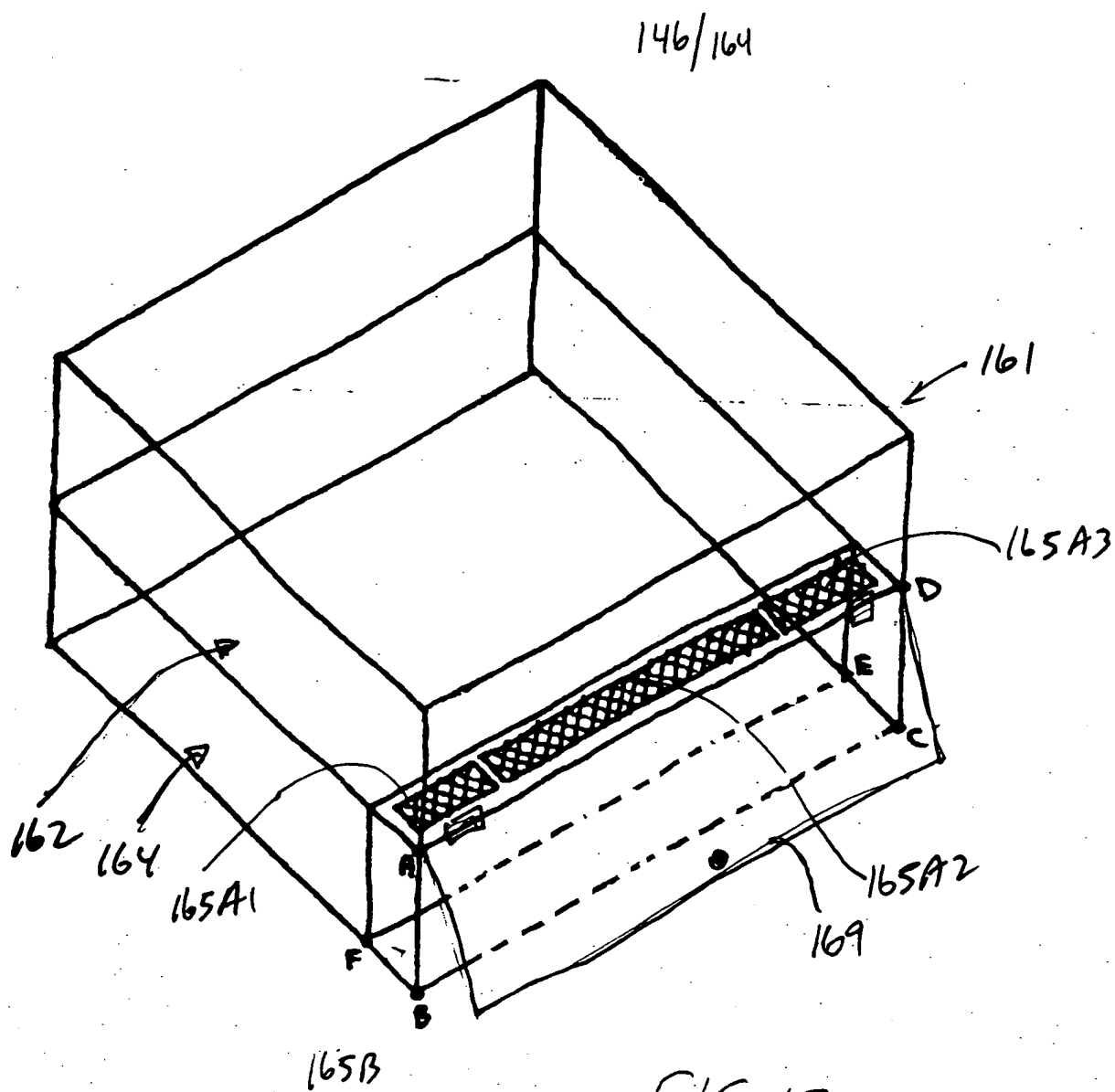


FIG. 15

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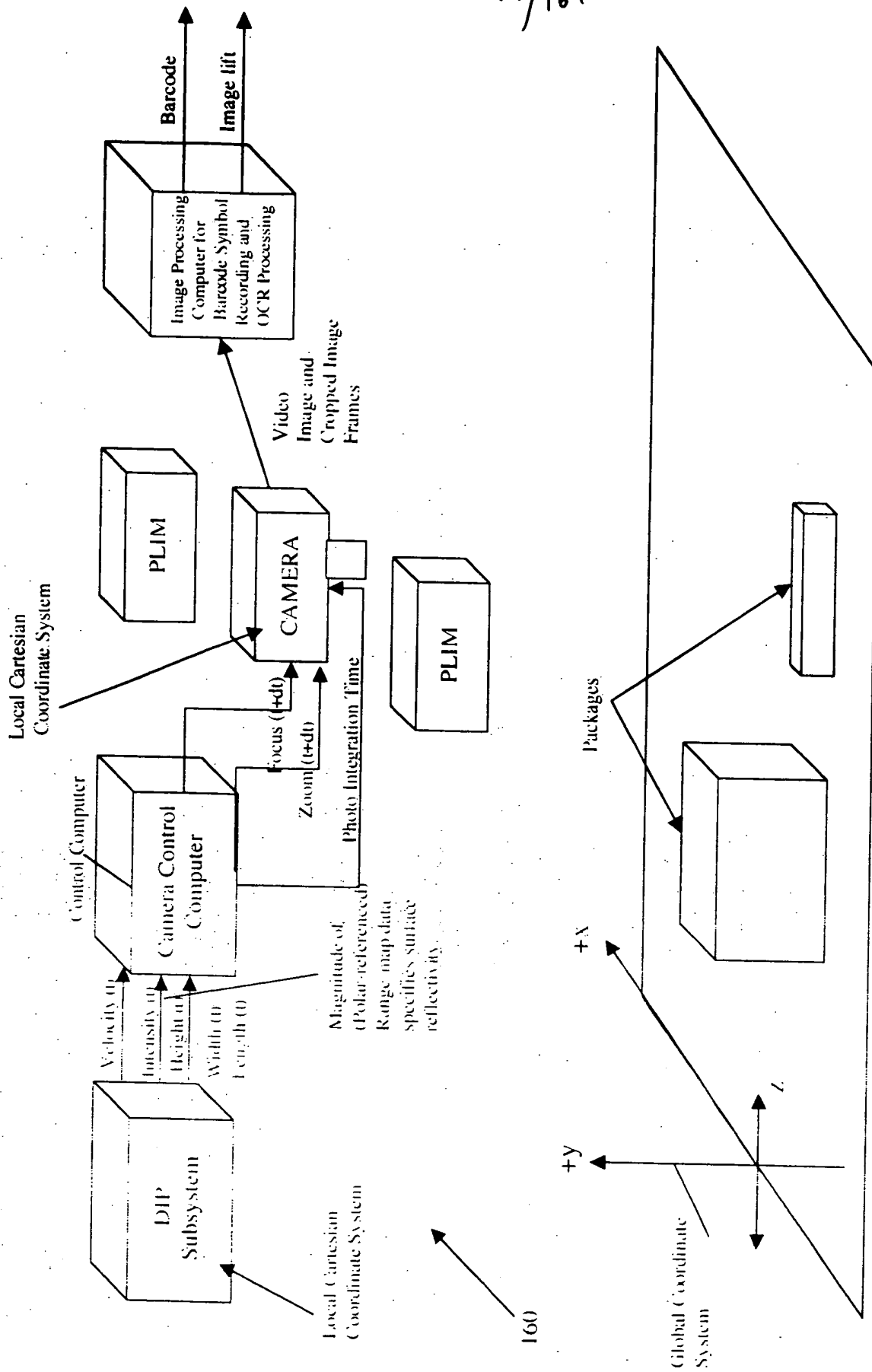


Fig. 16

FIG. 17

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upper deck
top view

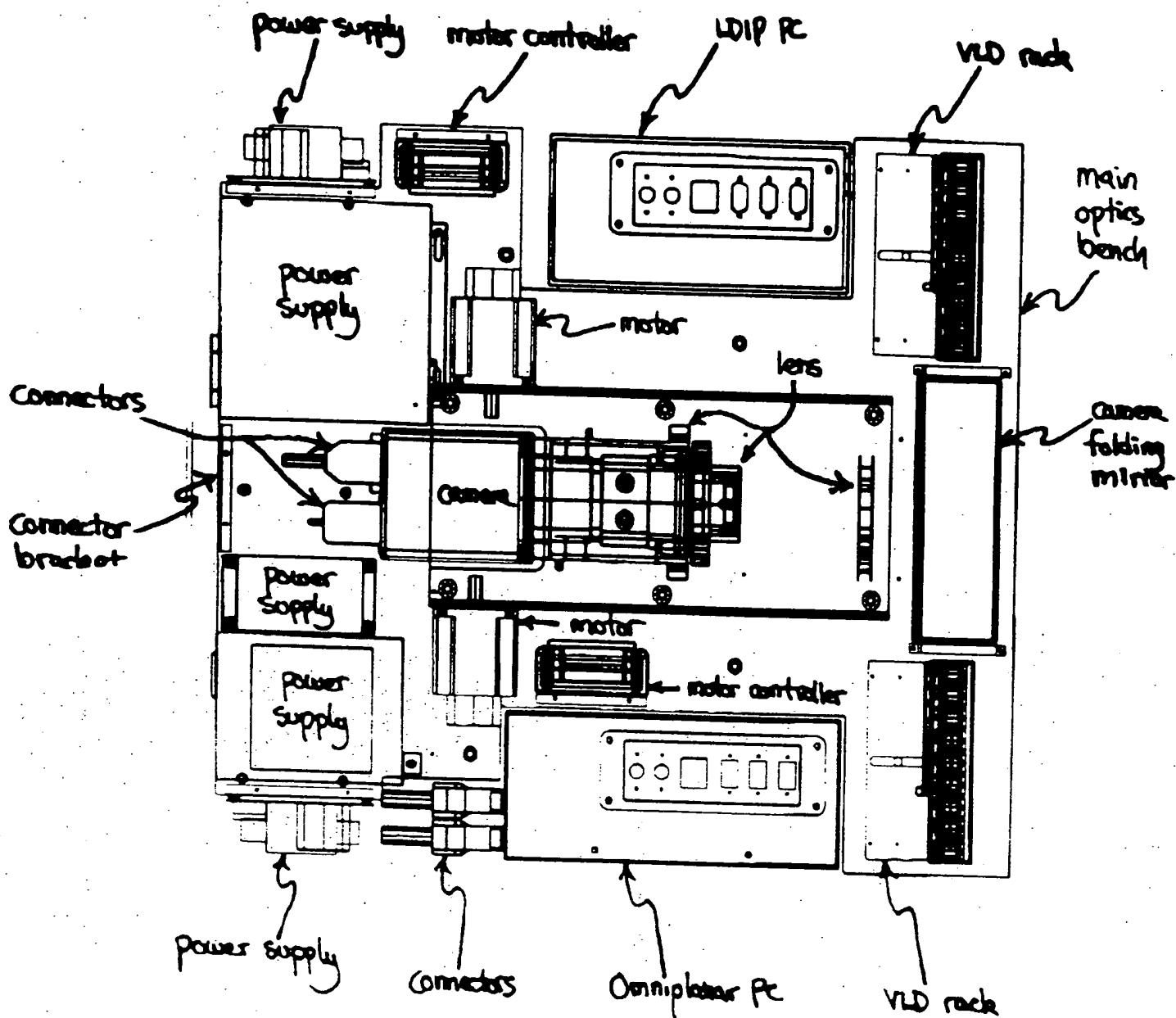


FIG. 18A

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lower deck
top view

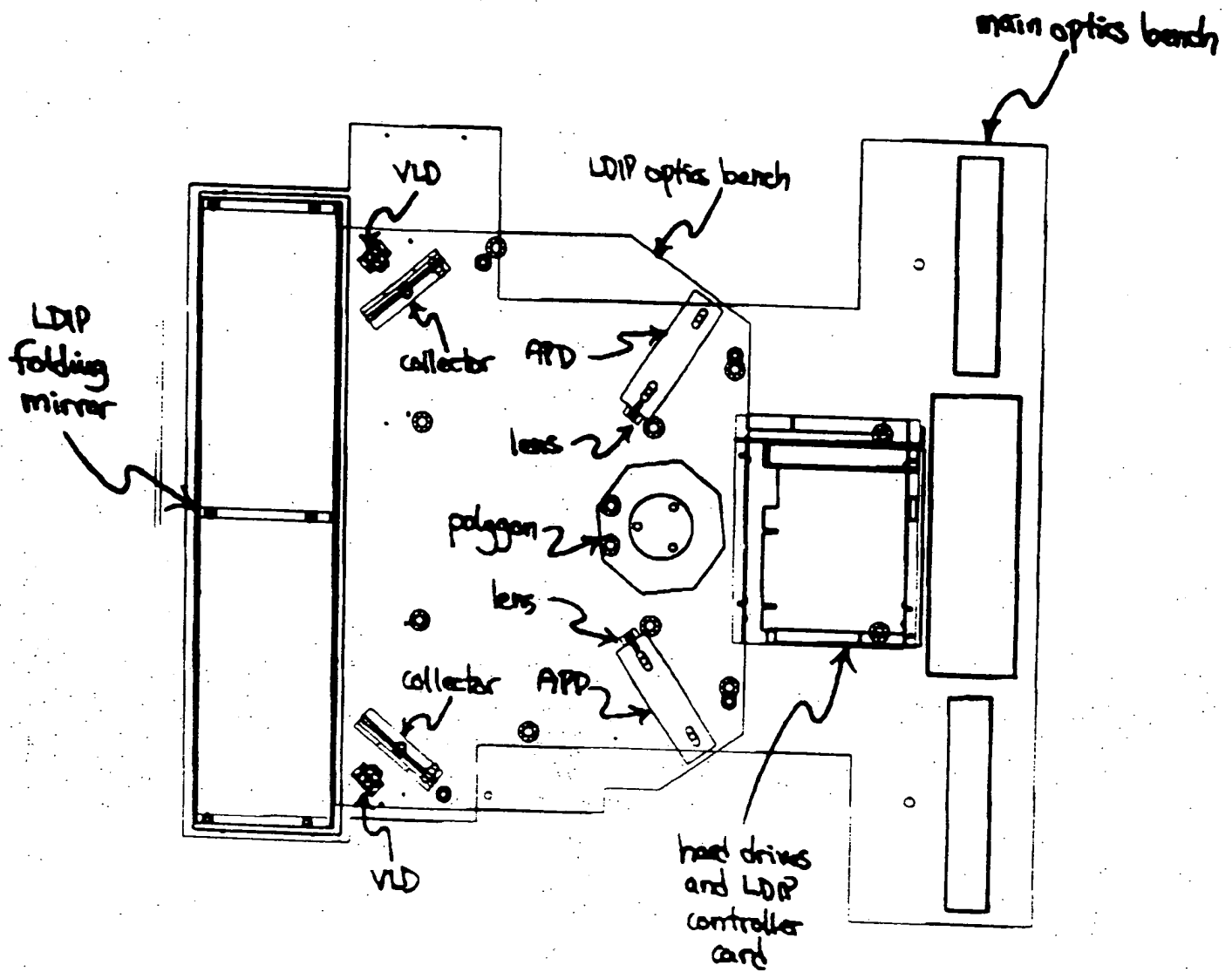
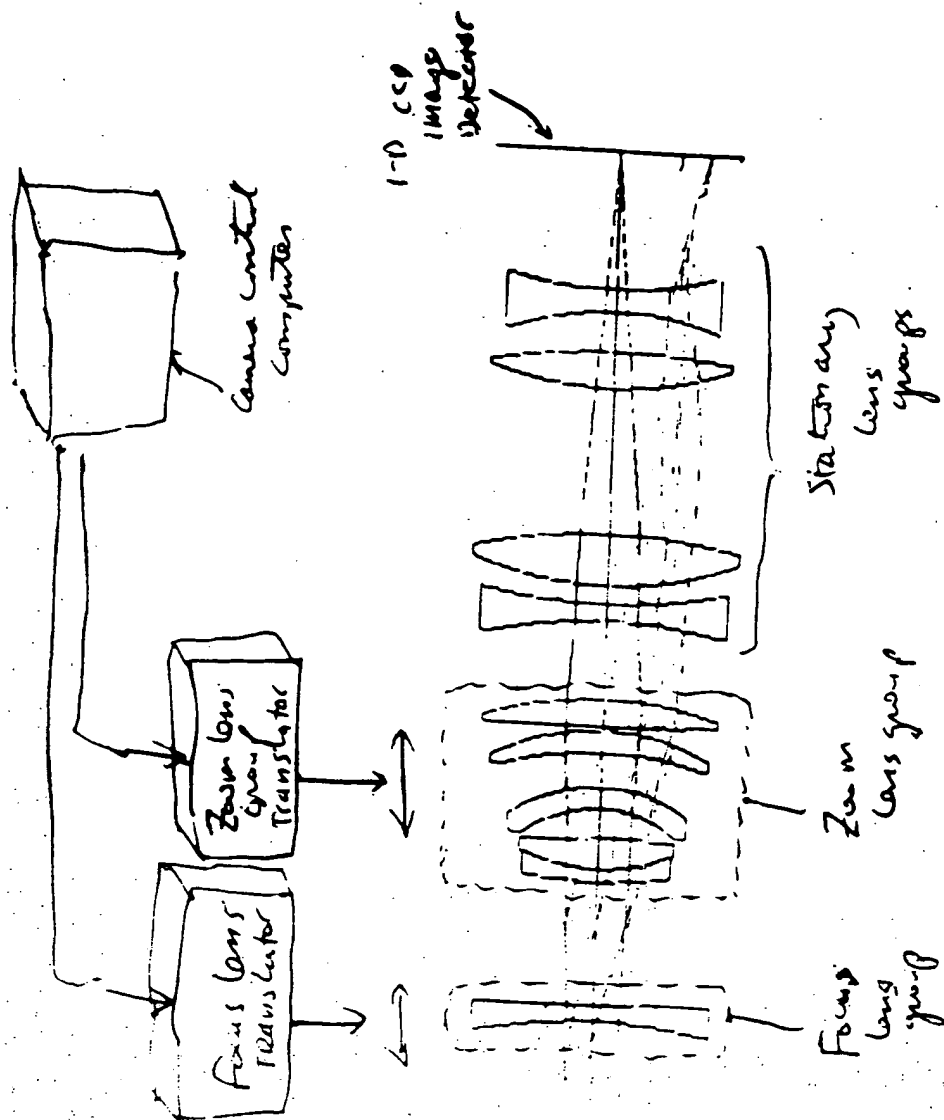


FIG 1EB

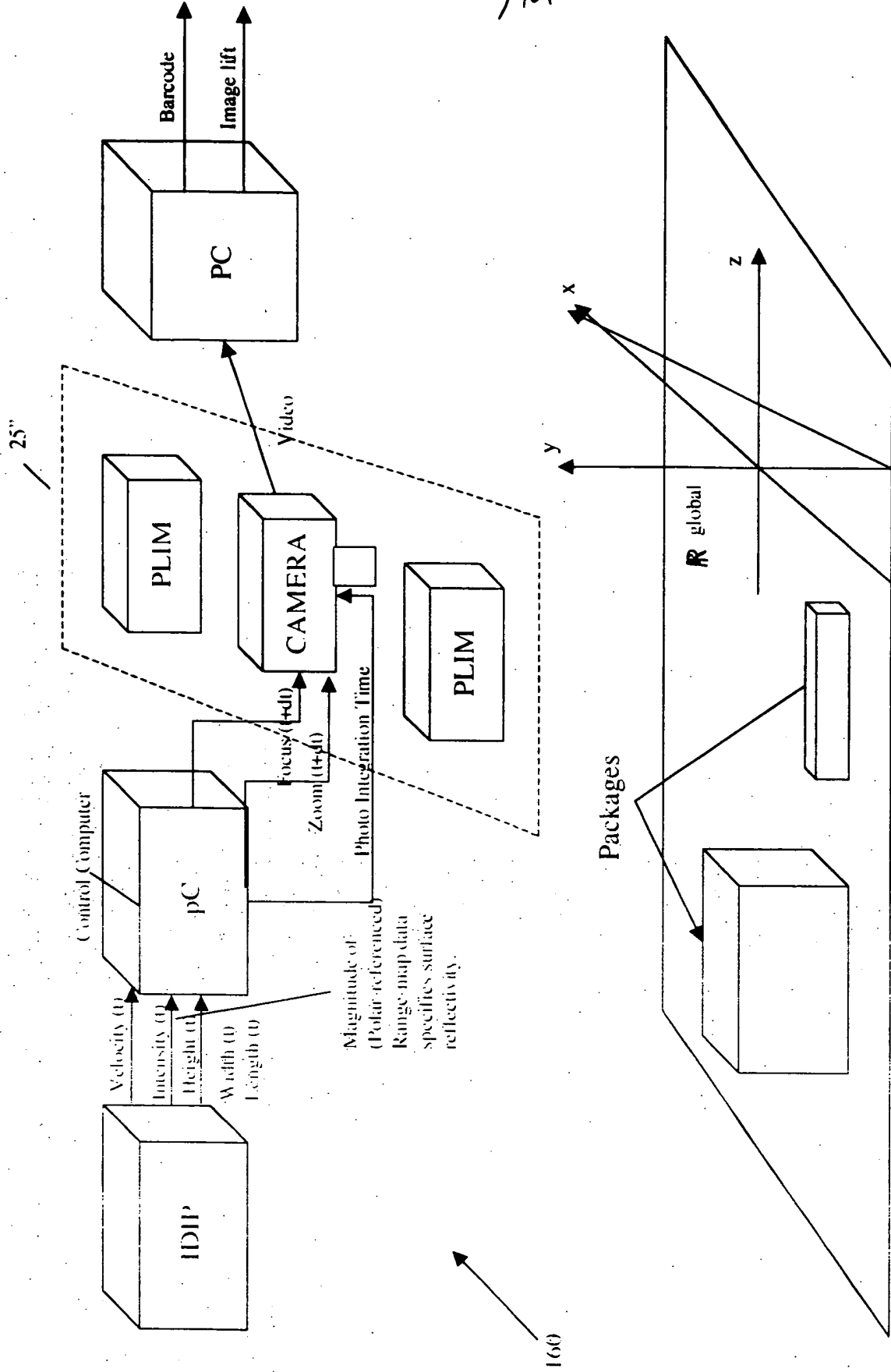
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(main optics)
(lens groups)

FIG 18C

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PLIM-BASED PACKAGE IDENTIFICATION AND DIMENSIONING (PID) SYSTEM

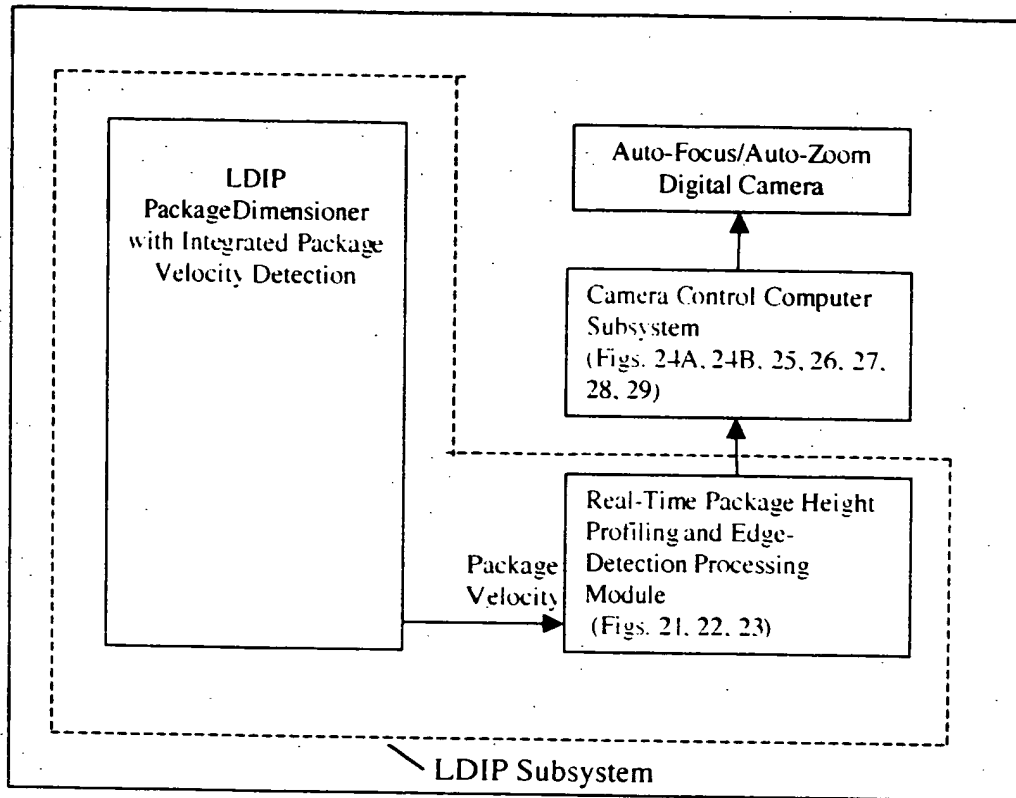


Fig. 20

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LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

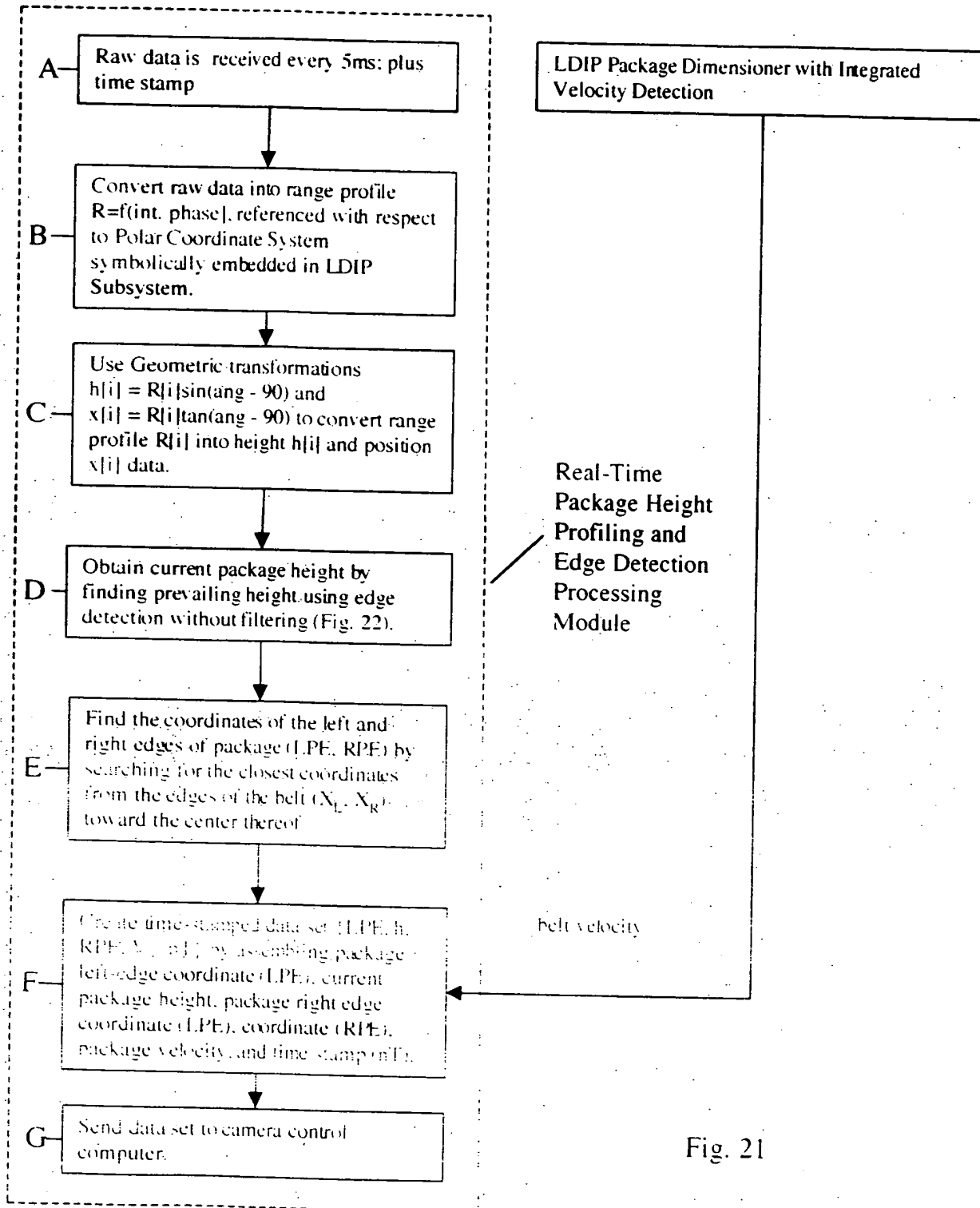
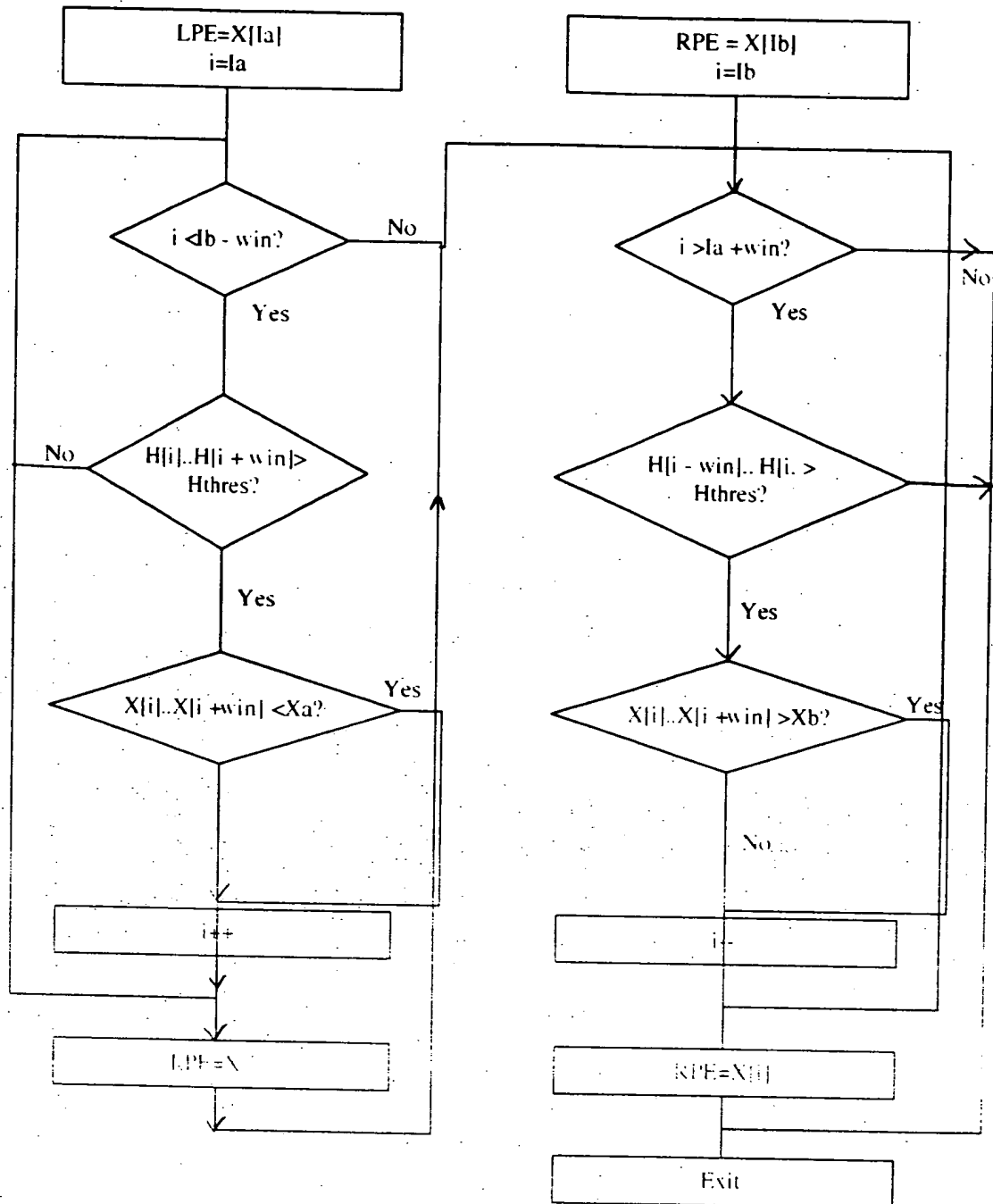


Fig. 21

REAL-TIME PACKAGE EDGE DETECTION METHOD



X_a = location of belt left edge; X_b = location of belt right edge
 l_a = belt left edge pixel; l_b = belt right edge pixel
 LPE = Left package edge; RPE = Right package edge
 $H[i]$ = Pixel height array; $X[i]$ = Pixel location array
 win = package detection window

Fig. 22

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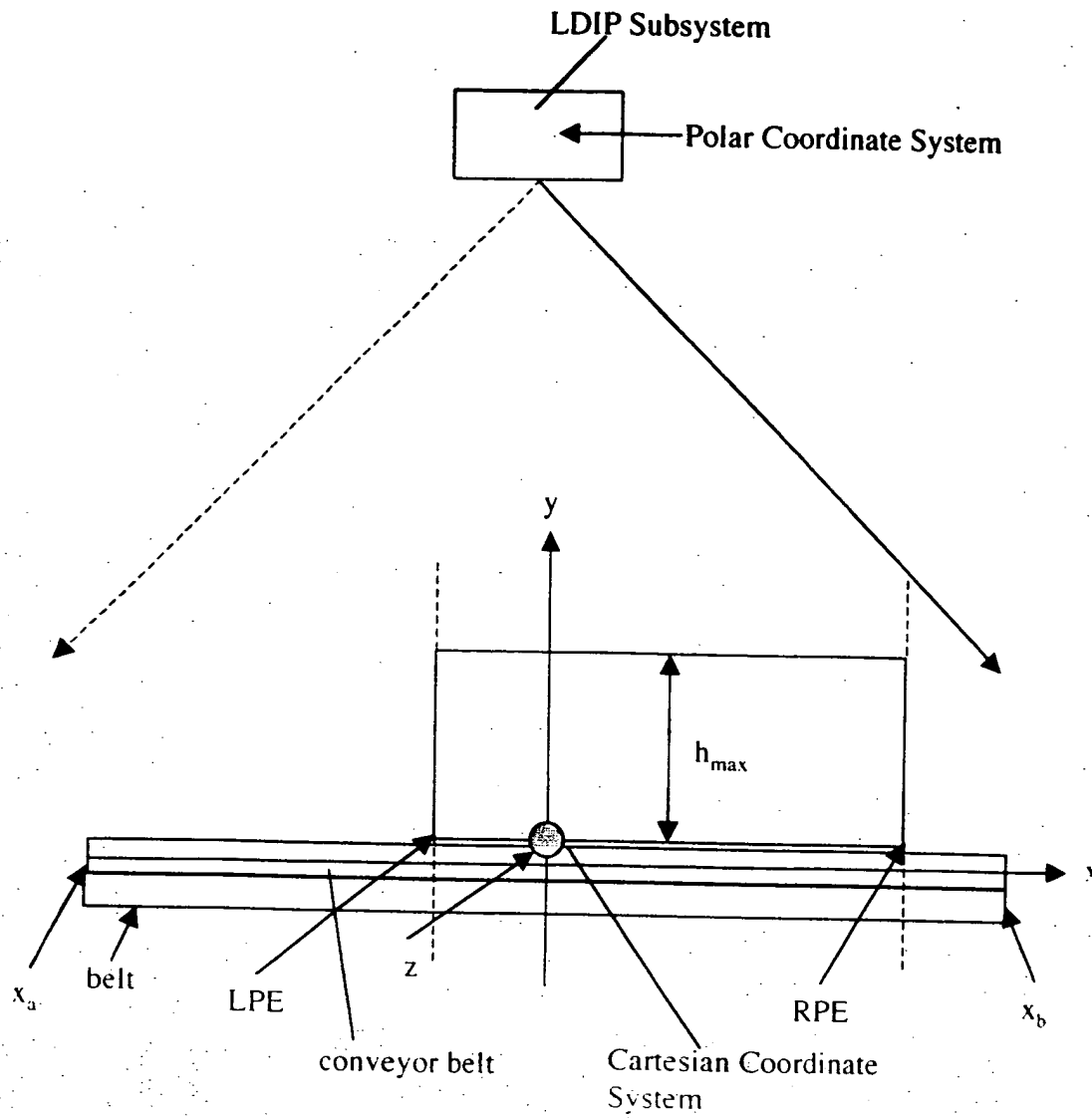


Fig. 23

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CAMERA CONTROL PROCESS CARRIED OUT WITHIN THE CAMERA CONTROL SUBSYSTEM

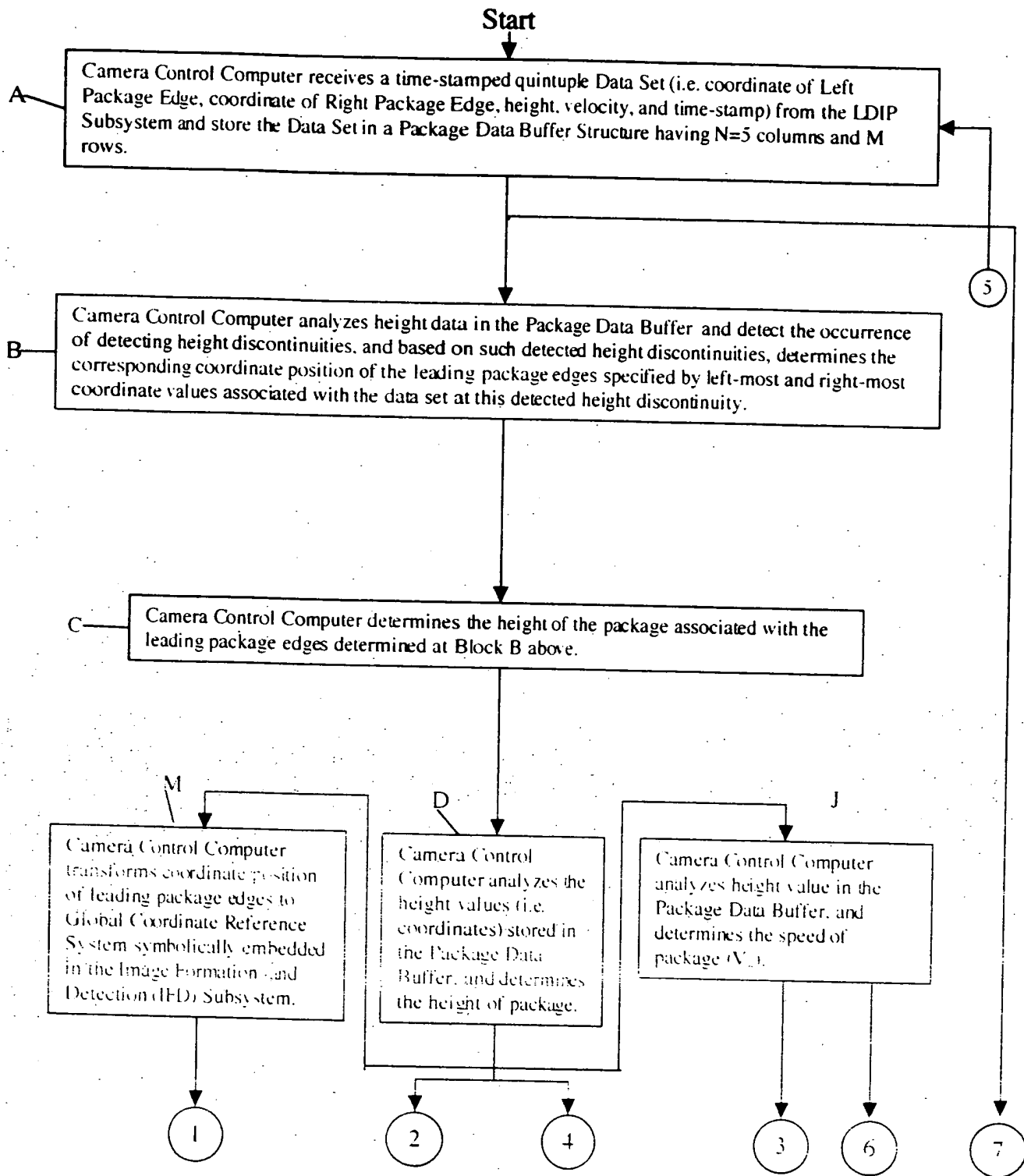


Fig. 24A

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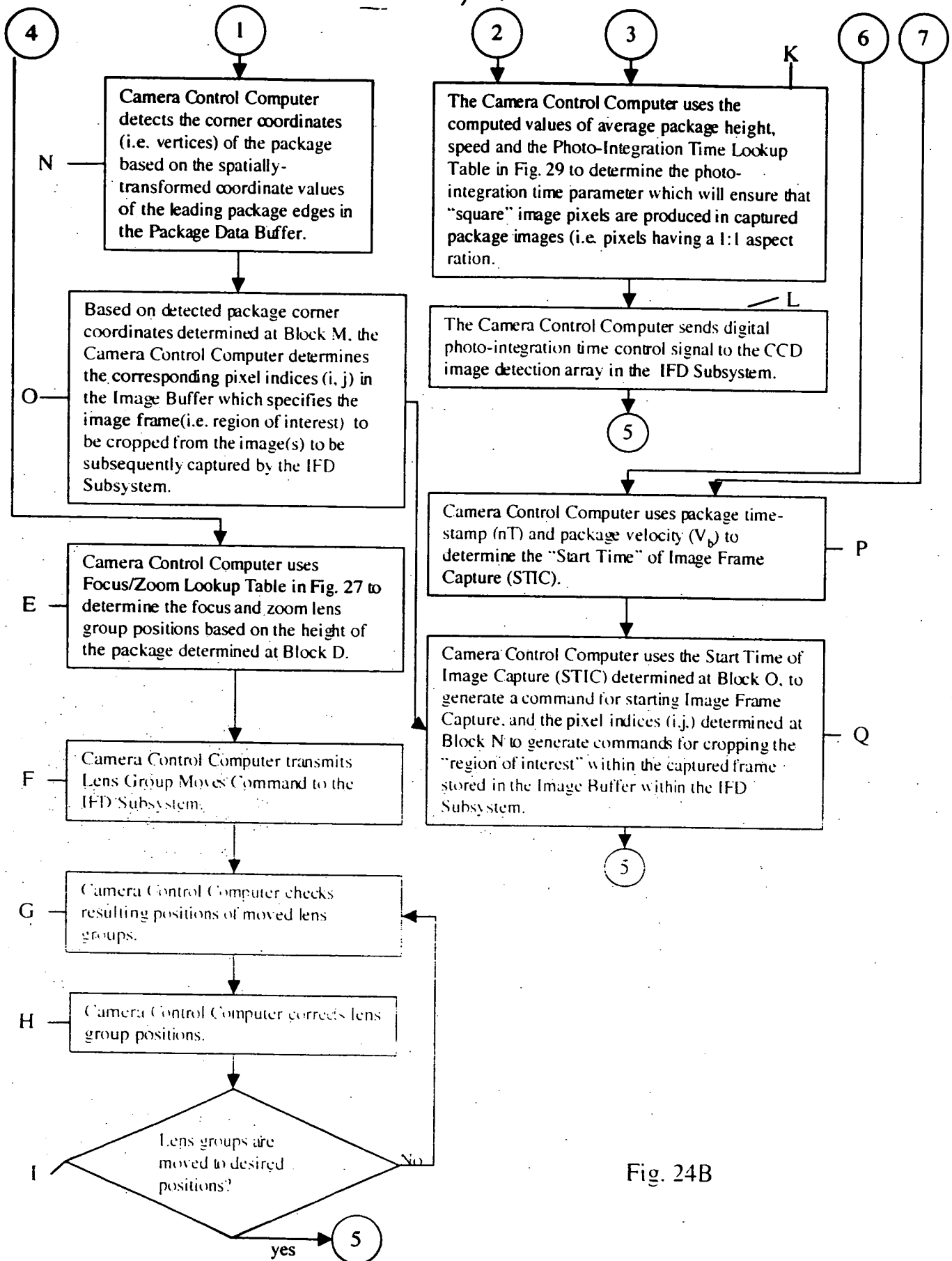


Fig. 24B

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Left Package Edge (LDE)	Package Height (h)	Right Package Edge (RPE)	Package Velocity	Time-stamp (nT)	
					Row 1
					Row 2
					Row 3
					Row 4
					Row 5
					Row M

Package Data Buffer (FIFO)

Fig. 25

																				Columns →
																				Rows ↓

Camera Pixel Data Buffer
pixel indices (i,j,)

Fig. 26

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Position and Focus Lens Group Position
Looking Table

Distance from Camera H (mm)	Zoom group distance (mm) Y (Zoom)	Focus group distance (mm) Y (Focus)
1000	21.57489228	2.47E-05
1100	19.38089696	10.99009783
1200	17.10673434	20.65783177
1300	14.77137314	29.10917002
1400	12.39153565	36.47312595
1500	9.979114358	42.87845436
1600	7.540639114	48.44003358
1700	5.078794775	53.25495831
1800	2.595989366	57.40834303
1900	0.099972739	60.98883615

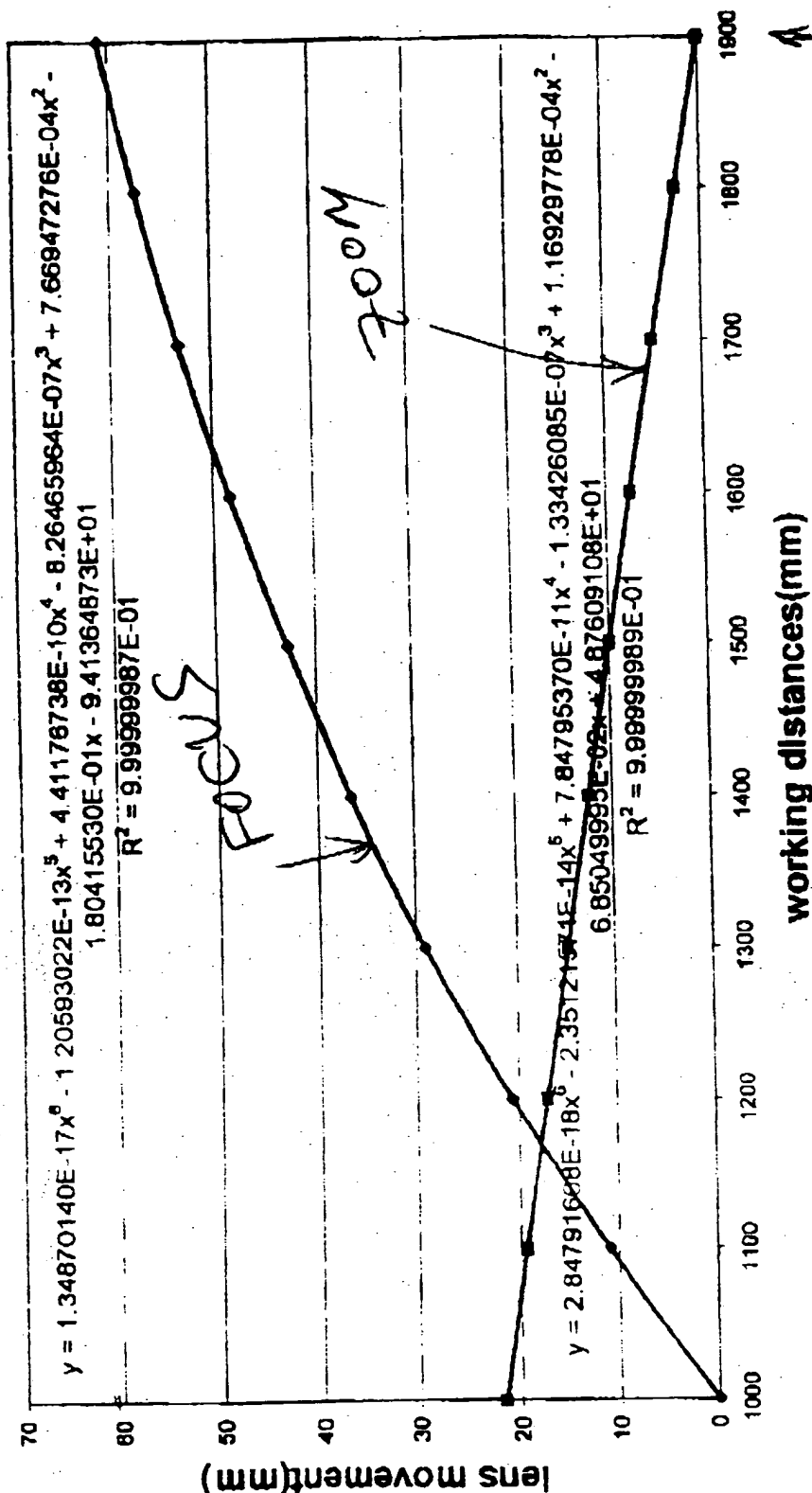
(use
interpolation
technique
for working
distances
between listed
points in
table)

FIG. 27

camera has a
fixed aperture F5.6

Fig

Focus and Zoom lens movement vs. working distances



36 above conveyor belt

← Package height above conveyor

conveyor-belt
surface

FIG 28

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600 feet per minute
(FPM)

Photo-Integration Time Look-Up Table

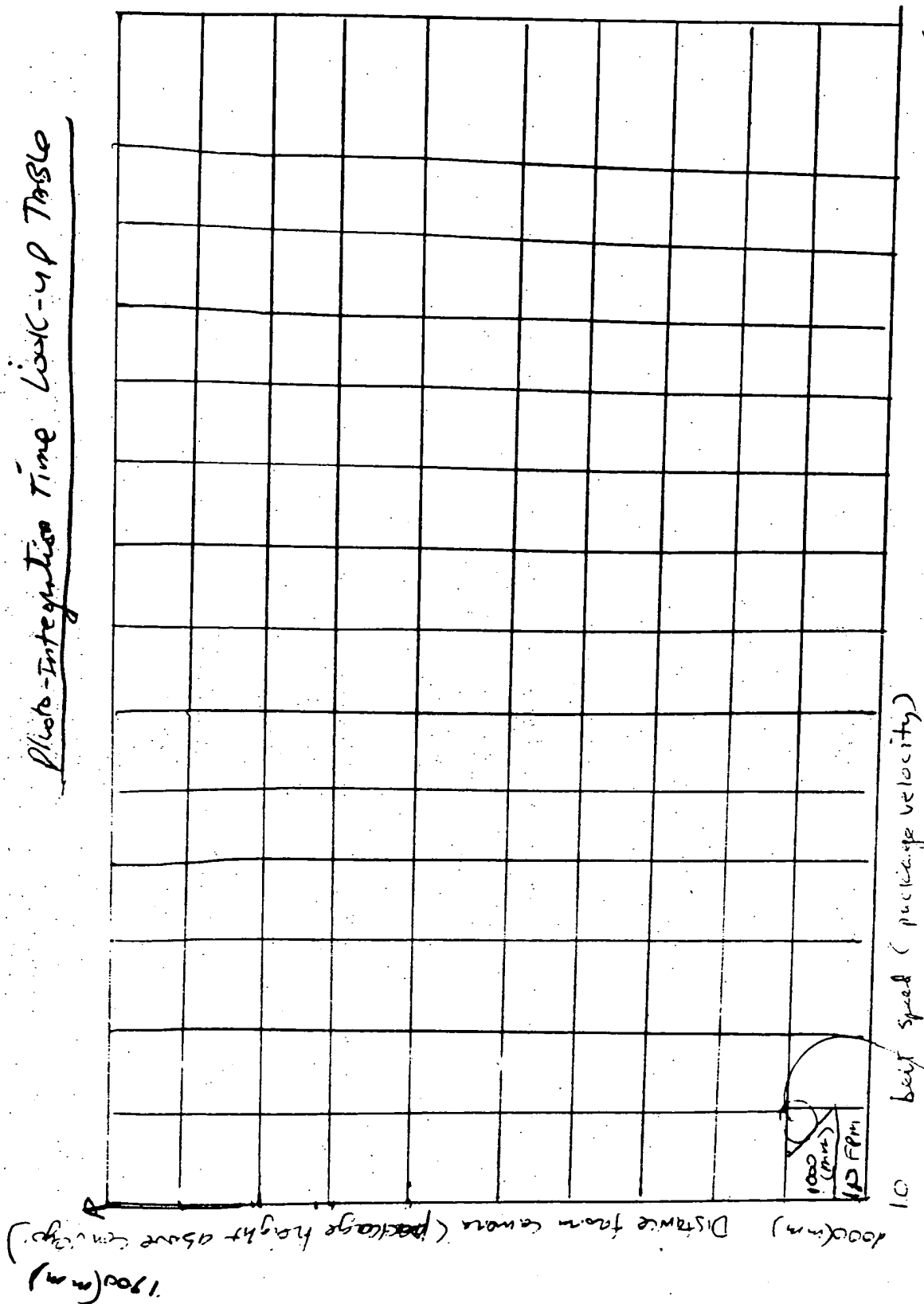


FIG. 29

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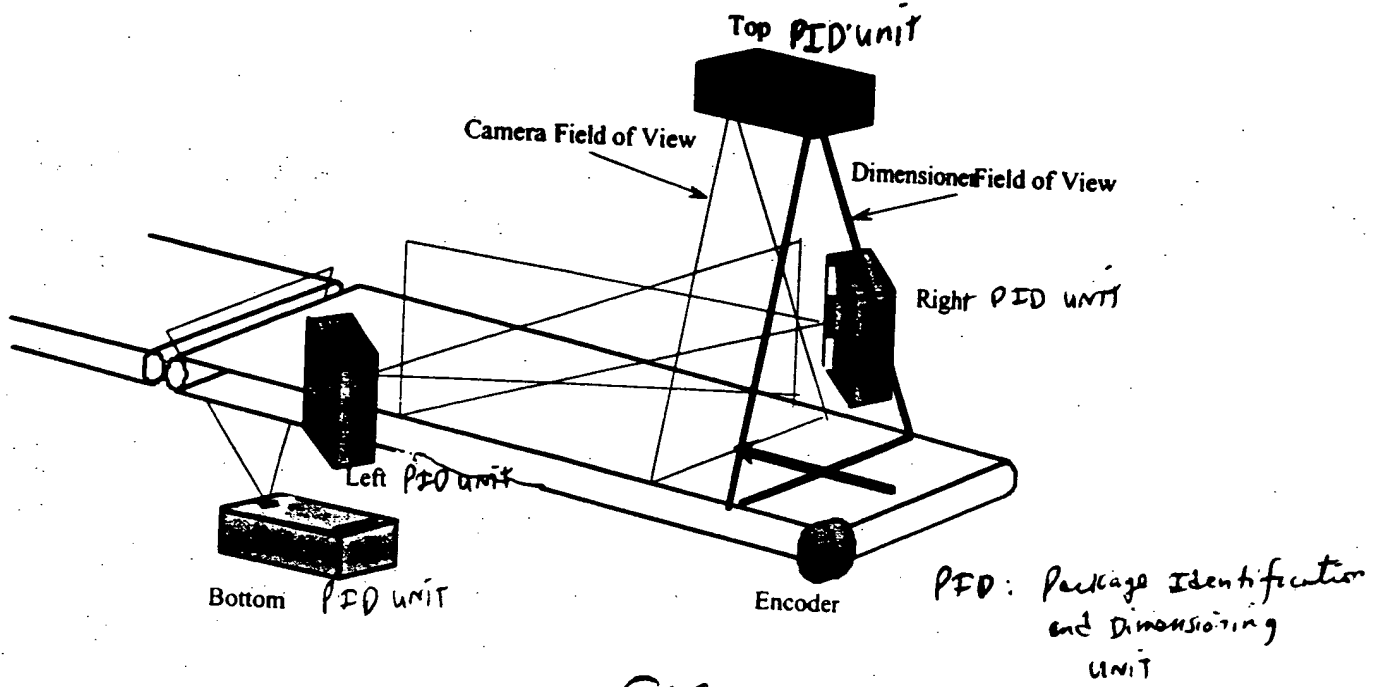


FIG. 30

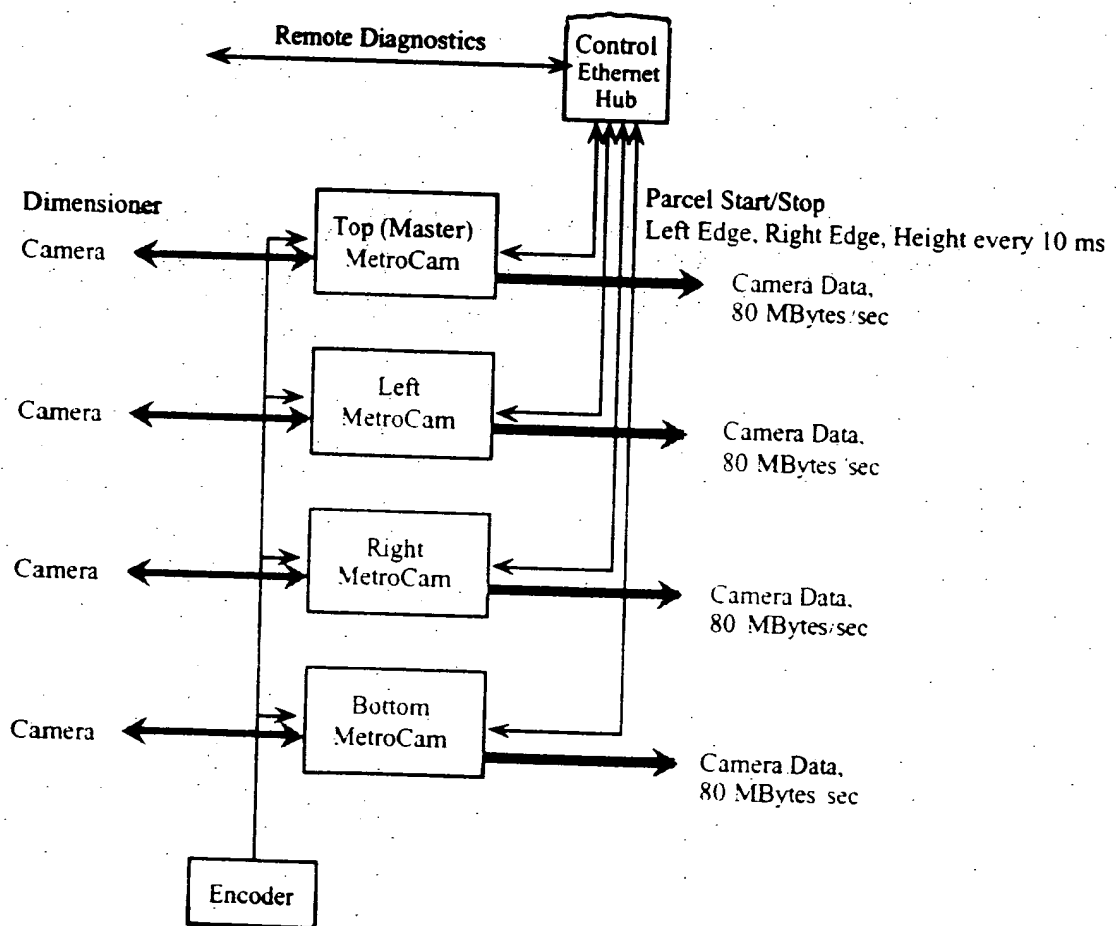


FIG. 31

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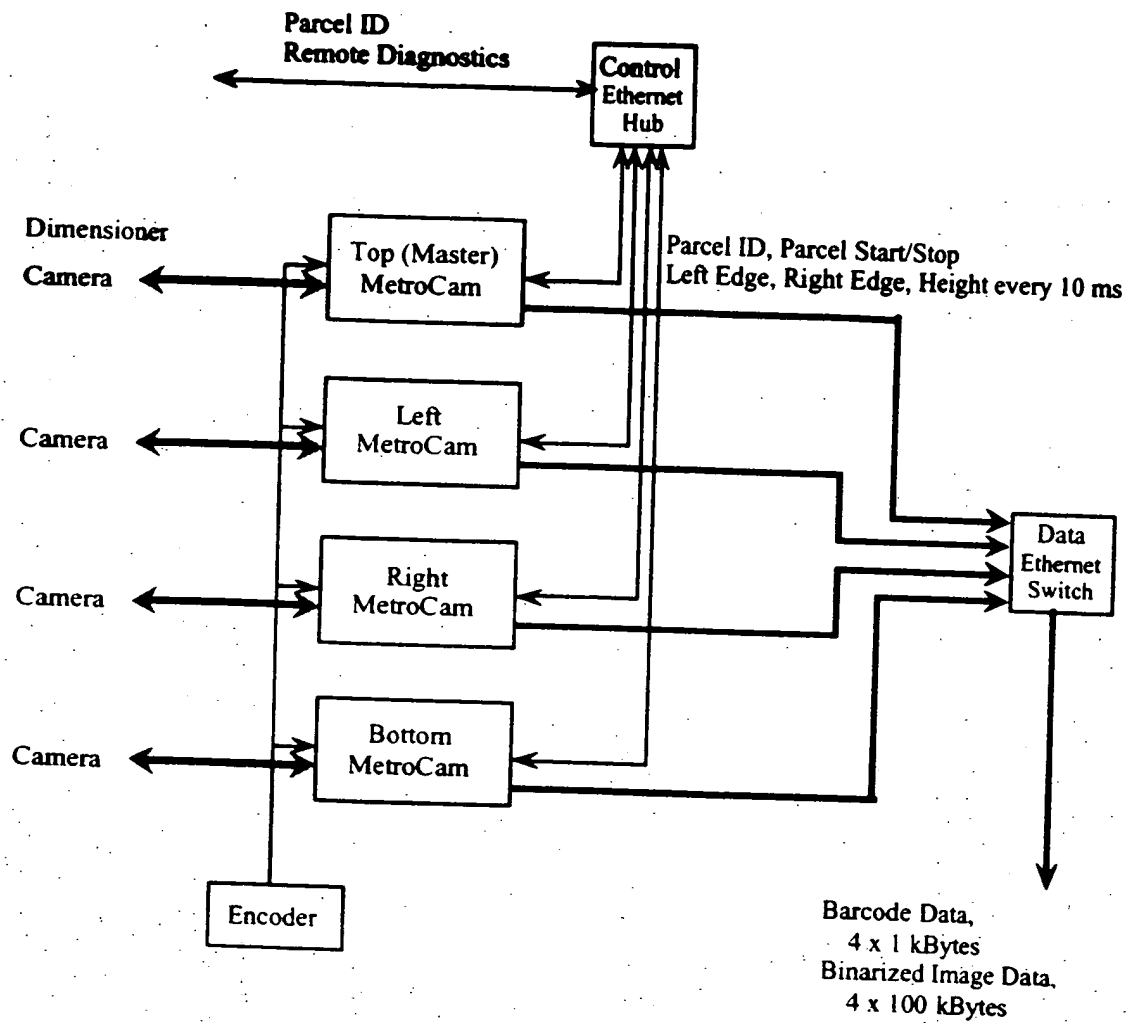


FIG. 32